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THE WORLD'S MEAT

THE WORLD'S MEAT

BY

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D. APPLETON AND COMPANY
NEW YORK LONDON
1927

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PRINTED IN THE UNITED STATES OF AMERICA

PREFACE

THE questions connected with the production, distribution, and consumption of food have interested a few people for a long time. The growth of dense centers of industrialized populations, the rapid rise of food prices after the end of the last century, and more particularly the disturbances connected with the war brought home to the masses that there was a very practical food problem, and the popular interest in the problem has stimulated much study of many phases of the question. Unfortunately many serious conclusions are being drawn from less serious study of the real facts.

One fact does stand out in the modern discussions of food: it is becoming increasingly a world problem rather than a matter of mere local interest. Nations and their various sections have their own food problems which may be serious, but among civilized peoples the local problems are part of the larger world questions and cannot be solved on local lines alone.

The author's interest in food problems was stimulated by war-time control work. As statistician for the Canada Food Board and later as Cost of Living Commissioner in the Dominion of Canada he had an opportunity to observe the seriousness of the food question and the fact that no one nation stands by itself in this question. The subsequent opportunity to study the food problems as a member of the faculty of one of the leading agricultural colleges situated in a state which is much more a consumer than a producer has given an opportunity for a broader viewpoint.

The question of all classes of foods is too immense to handle in one volume with the thoroughness needed, and meat has been selected as a particular food of great importance in itself to the civilized world and one whose importance is most subject to dispute between the various schools of thought interested in food problems.

It would be impossible to mention all by name to whom the author is indebted for various types of assistance in preparing this work. Many libraries have been called upon for assistance, including those of the Departments of Agriculture in Washington and Ottawa. Many of my colleagues in both the Massachusetts Agricultural College and the Institute of Economics have been called upon for assistance and suggestions. Particular indebtedness must be acknowledged to officials of the Departments of Commerce and Agriculture at Washington and to representatives of the meat trades for the use of material and also for critical assistance. Mr. Donald W. Sawtelle has drawn a number of the original charts and Mr. Robert F. R. Martin has assisted in gathering together some of the statistical material. My wife has shared fully in all stages of the work and much of the credit for its completion is due to her.

ROBERT J. MCFALL.

CONTENTS

PAGE

PREFACE v
INTRODUCTION xv

PART I

MEAT AND THE FOOD PROBLEM

CHAPTER

I. THE IMPORTANCE OF MEAT AS A FOOD 3
The Different Classes of Food and Their Functions . 4
The Essential Character of Proteins 7
Meats Furnish Man a Superior Type of Protein . . 11
The Importance of Fat in Meats 21
The Mineral Requirements in Meats 25
Meats and Vitamins 27
Objections Which Are Raised to the Use of Meat . . 31
Why Meat Is a Good Food 36
How Much Meat Should Be Eaten 36

II. THE RELATION OF MEAT TO FOOD PRODUCTION . . . 41
The Chemical Processes of Food Production . . . 42
Competition between Man and Beast for Vegetable Food 44
Relative Economy of Different Animals as Food Producers 47
Relative Efficiency of Younger Animals 54
Pasture versus Cultivated Crops for Feed 56
Animal Husbandry and Soil Fertility 57
Economy of Turning Vegetable Products into Meat 64
Unquestionable Economy of Animal Husbandry Based upon Food Not Usable by Man 66

III. THE DISTRIBUTION AND DEVELOPMENT OF MEAT PRODUCTION 68
Animal Husbandry More Important in More Densely Populated Countries 68
Animal Husbandry in Various Stages of Economic Development 74
The Influence of Markets on Production 76
Influences of Social Factors 76

CHAPTER PAGE

The Availability of Feeds 76
The Influence of Climate, Topography and Soil . . 77
Areas Affected with Disease 79
The Influence of Improved Breeds 80

IV. Types of Meat Production 87
Types of Meat Production Vary with Stage of Economic Development 88
Frontier Method 90
Animal Husbandry Methods and Mixed Farming . . 92
The Baby Beef Industry 95
The Feeder Industry 96
Types of Sheep Production 102
Types of Pig Production 106

PART II

THE SITUATION OVER THE WORLD

V. The United States 111
Consumption 111
Production 120
The Beef Industry 125
Pork Production 135
The Sheep Industry 144
Foreign Trade 148
The Future of the Industry in the United States . 149
Alaska 152
Porto Rico 153

VI. Great Britain and Ireland 154
Consumption 154
Domestic Supplies of Meat 159
Production Conditions 164
The Cattle Industry 173
Sheep Husbandry 177
Pork Production 179
High Standards of Efficiency in the Live-Stock Industry 180
Possibilities of Increased Production 181
Dependence upon Imported Feed 182
Imported Supplies of Meat 184

VII. The Continent of Europe 188
France 190
Consumption 190
The Development of the Live-Stock Industry . . 194

CHAPTER PAGE

Beef Production 198
Pork Production 200
The Sheep Industry 200
Marketing of Live Stock 201
Relation to Agriculture 201
Foreign Trade 204
Spain 206
Portugal 210
Italy 211
Switzerland 224
Belgium 226
The Netherlands 234
Denmark 242
Germany 255
Consumption 255
Production 259
Austria 272
Hungary 278
Czecho-Slovakia 283
Yugoslavia 289
Roumania 294
Bulgaria 297
Greece 299
Norway 301
Sweden 302
Finland 306
Poland 307
The New Baltic States 310
Russia 311

VIII. CONDITIONS IN ASIA 325
Asiatic Russia 326
China 330
Manchuria 341
Mongolia 342
Tibet and Sinkiang 345
Korea 345
Japan 346
The Philippines 349
French Indo-China 351
Siam 353
British Malaya 354
Dutch East Indies 355
British India 356
Ceylon 361
Western Asia 362

CHAPTER PAGE

IX. AFRICA 366
The Union of South Africa 367
Basutoland 377
Swaziland 377
Southwest Africa 378
Bechuanaland Protectorate 379
Southern Rhodesia 380
Northern Rhodesia 386
Nyasaland 387
Tanganyika Territory 388
Kenya Colony and Protectorate 389
Uganda Protectorate 390
Anglo-Egyptian Sudan 391
British Somaliland 392
British West Africa 392
Egypt 396
Abyssinia 397
Belgian Congo 398
Angola 400
Portuguese East Africa 401
Eritrea 401
Italian Somaliland 402
Tripolitania and Cyrenaica 402
Liberia 403
French Equatorial Africa 403
French West Africa 404
Morocco 406
Algeria 408
Tunis 409
Madagascar 409

X. OCEANIA 413
Australia 413
Natural Conditions 413
The Sheep Industry 420
Beef Production 422
Pork Production 425
Internal Trade 426
Consumption 427
British New Guinea 428
New Zealand 428
Natural Conditions 429
The Sheep Industry 431
The Cattle Industry 434
Pig Raising 436

CHAPTER PAGE

Consumption 436
Export Trade 437
The South Pacific Islands 438

XI. South America 440
Argentina 441
Relation of Other Agricultural Developments . . 449
Export Trade 453
Domestic Meat Consumption 457
The Future Outlook 458
Uraguay 459
Paraguay 463
Brazil 467
The Guianas 474
Venezuela 475
Columbia 478
Ecuador 480
Peru 480
Bolivia 483
Chile 485
Falkland Islands 487

XII. The Caribbean Countries 489
Panama 489
Costa Rica 490
Nicaragua 491
Honduras 491
Salvador 492
Guatemala 493
British Honduras 494
Mexico 494
Cuba 497
Island of Haiti 498
The British West Indies 499

XIII. British North America 501
Canada 501
The Development of the Live-Stock Industry . . 502
The Cattle Industry 505
The Sheep Industry 508
Pork Production 510
Consumption 512
Foreign Trade 512
The Future of Canada's Live-Stock Industry . . 516
Newfoundland 518

PART III

MARKETING

CHAPTER PAGE

XIV. MARKETING PROBLEMS AND AGENCIES 523
Conditions Which the Marketing Service Meets . . 525
Fitting Production to Consumption 528
Inspection 531
Marketing in Europe 532
Marketing in Great Britain 533
Marketing in the Southern Hemisphere 536
Marketing in North America 537
Costs and Profits of Marketing 543

XV. COMBINATIONS IN THE MEAT TRADES 551
The American Packers 552
Packers in Canada 561
The American Packers in Foreign Countries . . . 562
British Combinations 565
Coöperative Enterprises 566
Government Control Boards 567
The Place of Big Business in Meat Marketing . . . 568

XVI. INTERNATIONAL TRADE 571
The Leading Nations in International Trade . . . 572
The Early Trade in Live Stock 575
The Early Trade in Cured Meat 587
Trade in Refrigerated Meat 588
Inspection to Protect Health 590
The Development of Foreign Trade in the Leading Countries 591

PART IV

CONCLUSION

XVII. THE FUTURE OF THE MEAT INDUSTRIES 603
Consumption Has Been Increasing 603
The Relative Growth of Meat Production and Agriculture 606
The Future Outlook 613

INDEX 619

CHARTS

		PAGE
1.	Cattle Dispersion in Europe	70
2.	Density of Population in Europe *facing*	70
3.	Swine Dispersion in Europe	71
4.	Relation of Density of Population and Number of Cattle in 21 European Countries	72
5.	Relation of Population to Number of Cattle in the United States	114
6.	Changes in Sheep Population and Slaughter—U. S. A.	115
7.	Cattle (Excluding Milch Cows), Number on Farms and Ranges, June 1, 1850	122
8.	Cattle (Excluding Milch Cows), Number on Farms and Ranges, June 1, 1860	123
9.	Cattle (Excluding Milch Cows), Number on Farms and Ranges, June 1, 1880	124
10.	Cattle (Excluding Dairy Cows and Calves), Number on Farms and Ranges, June 1, 1900	125
11.	Cattle (Excluding Dairy Cows), Number on Farms and Ranges, Jan. 1, 1920	126
12.	Steers 2 Years Old and Over, Number Jan. 1, 1920	127
13.	The Four Areas of Beef Production	131
14.	Railway Shipment (Cattle and Calves) 1918	133
15.	Number of Hogs, 1860	137
16.	Number of Hogs, 1880	138
17.	Number of Hogs, 1900	139
18.	Number of Hogs, 1920	140
19.	Corn Production, 1919	141
20.	Corn and Hog Ratio, 1910 to Date	143
21.	Price and Purchasing Power of Hogs	144
22.	Sheep on Farms and Ranges, Number Jan. 1, 1920	145
23.	Australia, Number of Cattle, Sheep, and Pigs, 1860-1925	423
24.	New Zealand, Exports of Wool and Frozen Meat, 1882-1925	433
25.	New Zealand, Number of Cattle, Sheep, and Pigs, 1883-1925	435
26.	The Armour and Morris Branch House System	539
27.	The Armour and Morris Car Route System	540
28.	Proportion of the Consumer's Beef Dollars Received by the Producer for the Beef Content of the Live Animal	544
29.	Cattle Operations, Fiscal Year 1923	546
30.	Weights and Prices of Retail Cuts from a Side of Beef	548

PAGE
31. Pork Products from a 250-Pound Hog—Finished Weights 549
32. Armour and Morris Foreign Houses and Agencies . . . 553
33. British Import of Chilled and Frozen Beef, 1882-1925 . 592
34. British Imports of Frozen Mutton and Lamb 1882-1925 . 593
35. United States Beef, Annual Surplus Exported 594
36. United States Pork, Annual Surplus Exported 596
37. Danish Bacon and Pork Exports, Showing Portion Shipped to Great Britain, 1889-1925 598

INTRODUCTION

THE production of meat for food and the industries engaged in rendering this food available for human consumption take a leading place among the world's leading economic activities. Of this there is no question. How essential meat is to man's welfare and how long it will continue to be produced are frequently questioned. The fundamental importance of meat for human well-being and the probability of the industries connected with its production and distribution retaining their relative position in economic affairs present problems of real weight.

Probably no single industry utilizes so much of the earth's surface as that of meat production. Some sections of the globe are more taken up with the growth of forests than the raising of stock, but as a rule these extensive forests are yet in their native state and practically unused by man. In some few sections true agriculture has taken over a larger share of the area than is devoted to animals. As a rule, however, a large share of the cultivated ground is used for growing forage for live stock even under intensive agricultural conditions. This is strikingly true in some of the most advanced countries of western Europe. In the less developed countries of the new world it is not to be wondered at that much of the area is given over to grazing and other forms of fodder production.

Needless to say, in the conduct of this industry and in the marketing of its products a very large amount of capital and vast numbers of people find employment. The meat industries as they stand are intrinsically im-

portant and their immediate disappearance would be an impossibility.

Meat is also very important from the standpoint of human nourishment, and this importance is far from diminishing as the centers of greatest economic activity and attainment in modern civilization are approached. Maps of the earth indicating the intensity of *per capita* meat consumption and the relative development of civilization, as presented by Ellsworth Huntington, would show a striking degree of similarity. There would be exceptions in the case of the high actual consumption of meat in the Arctic regions, where other food is very limited in availability, and in some of the newer countries where the apparent consumption, more or less inflated by waste, is no index of a higher stage of civilization nor yet of economic attainment.

It is very commonly claimed that meat is not an essential part of man's diet and that its production is so expensive in terms of natural food-producing resources that the growth of human population will soon force its abandonment. If such is the case, a serious situation must be faced by many of those engaged in the various industries related to meat. If, on the other hand, meat-eating is essential to man's highest well-being but is in danger of being seriously reduced by the increasing demands for bread alone, a serious situation confronts more than those directly engaged in the industry. The question of meat production and consumption is in the very forefront of what is popularly known as the Malthusian controversy. Is the human population about to expand so much more rapidly than the food supply that man will be driven to curtailing his consumption of all food except the bare essentials? If so, meat consumption must almost certainly be given up even though it be vital to man's highest well-being. On the other hand, if, as the discussion in the following pages

indicates, man can increase nature's gifts more rapidly than he multiplies himself, the meat industries may not only continue but even increase in relative importance.

Thus a study of the meat industries has significance from the social as well as the commercial point of view. Many of the outstanding problems connected with the industries are also world problems. While but a small proportion of the total world production moves into the streams of international trade, yet these industries in many of the leading nations are becoming more and more closely related to each other through world commerce. The social problem of the place of meat in either an increasing or restricted food supply is distinctly a world question. While there is world commerce those nations which can afford to pay for it will have meat more certainly than those who produce it.

In the following pages an attempt is made to deal with the problems of the place of meat in the diet and in food production, to outline the main features of the situation in the various countries of the earth, to present some of the outstanding factors in the marketing of meats and to discuss the present and probable future trends of meat production in the light of present conditions and the outstanding factors in the relation between the increase of man and his food supply.

PART I

MEAT AND THE FOOD PROBLEM

THE WORLD'S MEAT

CHAPTER I

THE IMPORTANCE OF MEAT AS A FOOD

MEAT takes a very large place in the diet of the peoples of western civilization and its use is increasing in the older western nations. Aside from those who are dependent upon hunting or the pastoral life for their existence, the use of meat is relatively small among the less highly civilized peoples and the Orientals. Religious considerations and climatic influences are partially responsible for the abstemiousness of many of those in the Orient. The low material standards of living there and among the relatively uncivilized peoples are also responsible to a large degree for its small use outside of the influences of western civilization. In the occidental nations, however, the consumption of meat is generally very important.

The use of meat is most notable among the nations of western Europe and those nations in the New World which have been founded by western Europeans. Those nations which have been the most vigorous colonizers of modern times and which are the most advanced in the achievements of this industrialized age are the heaviest meat eaters. The United States, Canada, Argentina, Australia and New Zealand in the New World and Britain and the nations in the western part of the continent of Europe use the most meat per head of the population. The newer countries are the heaviest users, partially because of a

relative superabundance of this food. The extremely large apparent consumption, which is probably largely wastage, is diminishing in some of these countries as the supply becomes less superabundant. In the older nations, however, meat consumption, throughout a long series of years, is undoubtedly increasing.

The more striking fact is that among these countries those which are more advanced in the arts of modern civilization are, as a rule, the heaviest users. Meat eating may not be the cause of greater virility, but it certainly seems to result when higher general standards of living are attained.

THE DIFFERENT CLASSES OF FOOD AND THEIR FUNCTIONS

The simplest function of food is that of supplying energy to keep the body warm and to supply the means for its activity. For this purpose any of the materials ordinarily considered as food are capable of meeting the bodily needs and their value for such a purpose can be determined quite accurately in energy units expressed as calories or units of potential heat production.

Foodstuffs are ordinarily classified chemically as carbohydrates, fats and proteins. These are the main classes of food elements and most food articles, excepting sugars, contain a certain proportion of each class, although meat contains little carbohydrate.

The building of bodily tissue requires the more complicated elements in the food which are called proteins.[1] The proper measurement of the quantity of the foodstuffs used for such purposes is not a simple matter. They are not primarily used for energy purposes and it is hardly the natural thing to evaluate them in energy units. Such measurement or valuation, although common, is not suffi-

[1] E. H. Starling, *Principles of Human Physiology* (1920), p. 71.

cient for determining their usefulness for these more complex functions.[2]

As already noted, any one of these groups of foods is capable of being used by the body to supply its energy requirements. Protein, however, is the basis for the building and reconstruction of the bodily tissues and as such no substitute is possible. Allied to the proteins are other still more elaborate materials which may be classified with the proteins. These may be combinations of proteins with other substances. While they are ordinarily present in the food and always present in the tissues of the body, they apparently can, if necessary, be constructed by the body out of protein and the other foodstuffs. Certain of these as combinations between fatty and nitrogenous chemical groups play an important function in the structure of the body.[3]

In addition to these three main groups of foods, the human body must necessarily have water, certain mineral salts and certain other newly discovered substances or properties of unknown nature which are popularly known as vitamins. Any one of these, water, mineral salts or vitamins is an absolute essential to health. Much discussion is being conducted to-day, however, about the latter, partially because of their novelty and their powers to baffle chemical analysis, more largely, probably, on account of the real danger of an insufficient amount being present in the diets of certain elements of the population, particularly the children.

The carbohydrates are the simplest forms of energy-bearing foodstuffs. The most common examples are sugars and starches.

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[2] E. V. McCollum, *The Newer Knowledge of Nutrition* (2d ed.), p. 45.

[3] H. C. Sherman, *Chemistry of Food and Nutrition* (2d ed., 1924), pp. 35-39.

There is a very large variety of fats, which include the oils. Like the carbohydrates, these fats are composed simply of carbon, hydrogen and oxygen in varying proportions in various combinations. The great difference between these two classes of foods is that the fats contain a smaller proportion of oxygen.[4] They might be described as largely deoxidized carbohydrates. Since the energy value of any food is its power to combine with more oxygen, these fats, which contain comparatively little of this element, have the greatest energy or contain the most calories per unit of weight. One other matter sets these food substances off very clearly from the carbohydrates; the latter must be dissolved in water, while fats do not require solution to be used in the body. This latter fact greatly increases their food value per unit of bulk in the food as it is digested and makes them practically indispensable in the human diet.[5]

The fats are broken up in digestion and re-formed in various parts of the body where they may be used at once for the production of energy or stored for future use. In this latter particular they differ from the carbohydrates.[6] This storage of fat may occur in various forms. Large amounts are found in any fat animal in the tissues immediately under the skin and around the internal organs. A surprising amount is also stored in the muscles themselves, even in health, and the liver is the depository for large amounts. Meat as it is ordinarily consumed contains a great deal of fat combined with the tissues.[7] Fats are also used in almost their pure state in the preparation of food either in the form of vegetable oils or animal fats such as

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[4] Starling, *op. cit.*, p. 37.
[5] Starling, *The Feeding of Nations* (1919), pp. 67-71.
[6] Starling, *Principles of Human Physiology*, p. 833.
[7] Commission Scientifique Interalliée du Ravitaillement, *Annexes au premier rapport.*

lard. Milk and its products supply fats of very high value and most cereal products contain a small percentage of fat.

THE ESSENTIAL CHARACTER OF PROTEINS

"Proteins are essential constituents of both plant and animal cells. There is no known life without them."[8] All proteins contain nitrogen and sulphur and many contain phosphorus in addition to the carbon, hydrogen and oxygen which compose the other food elements. They may also contain other elements, such as iron.[9] Nitrogen forms 15 to 18 per cent of the weight of this group of substances and they are ordinarily spoken of as nitrogenous compounds.[10] Proteins may be roughly regarded as the combination of nitrogen in the form of ammonia with combinations of carbon, hydrogen and oxygen related in some manner to fats, or oils, and carbohydrates.[11] The additional elements are also held in chemical combination. Thus, while carbohydrates and fats differ from each other in that the latter contain less oxygen and are accordingly of greater value per unit as heat producers, the added presence of the nitrogen and other elements in the proteins distinguishes them from both of these food substances and makes them indispensable as builders of bodily tissues in addition to being potential energy producers.

Proteins are much more complex substances than the other classes of foods. Any single protein is very complex, and proteins as a class of substances make a very elaborate series.[12] Nothing could be more misleading than the conception that all that is needed of a food as a tissue builder is for it to contain so much protein of undefined

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[8] Sherman, *op. cit.*, p. 42.
[9] Starling, *Principles of Human Physiology*, p. 74.
[10] *Ibid.*, p. 71.
[11] Sherman, *op. cit.*, 118-136; Starling, *Principles of Human Physiology*, pp. 805-808.
[12] Sherman, *op. cit.*, p. 43

origin. There are many different kinds of proteins and these differ very greatly in value for tissue formation.[13]

Proteins are built up from compounds called amino acids which contain all the chemical elements of the resulting protein. These amino acids are sometimes likened to "building stones" of which the protein structure is constructed.[14] There seems to be no certain knowledge as to the actual number of these amino acids which exist, but all the standard works on the subject list a large number of those which have already been discovered. Eighteen or more figure conspicuously in human nourishment.[15] Since these amino acids are all different and since the proteins of different origin contain unlike selections of them, it is very evident that the resulting proteins differ radically from each other.[16] The most interesting fact is that many differences exist between the amino acid content of the body tissues and that of many of the proteins in our ordinary foods.[17]

Very decided differences are also found among these foods in their content of these essential elements.[18]

Many proteins, particularly those of a vegetable origin, are deficient in some of the amino acids which are essential for the human body and contain a very much larger proportion of certain other amino acids than is needed.

By no means has 100 per cent of the amino acid content of any one of the proteins ever been accounted for. It has been impossible up to the present to analyze any of these substances completely and there is no real certainty that all the important amino acids have been isolated.[19]

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[13] W. M. Bayliss, *Principles of General Physiology*, pp. 255-257.
[14] V. Kellogg and A. E. Taylor, *The Food Problem* (1917), p. 110.
[15] McCollum, *op. cit.*, p. 85.
[16] Sherman, *op. cit.*, p. 46.
[17] *Ibid.*, pp. 60-61.
[18] McCollum, *op. cit.*, p. 96.
[19] Sherman, *op. cit.*, p. 46.

Some investigators have believed that the unanalyzed portion of the protein contained further amounts of the products already discovered rather than other amino acids not yet isolated. Since it has been pretty well established that milk from which the protein had been removed as completely as possible still contained sufficient quantity of protein or amino acids to affect the diet, and since the methods employed in analyzing the proteins may easily break up some of the amino acids before they are isolated, it seems highly probable that other essential amino acids may yet be discovered in the unknown portion of these proteins. Their presence or absence, or their proportion if present, may easily be of great importance to the value of these proteins as food. McCollum points out that lactalbumin—a constituent of milk—is an incomplete protein in respect to a certain missing complex or complexes, the identity of which has not been established.[20]

In digestion and assimilation the proteins are broken down into their constituent amino acids and in this form are distributed through the blood to all the tissues of the body. By some unknown process the tissues then take to themselves those particular amino acids of which they have need, whether for growth or for repair of wastage. The splitting up of the proteins into their "building stones" in digestion and their distribution in the blood in this form are very important on account of the variation in the composition of the proteins both in the food and in the various bodily tissues. Each tissue receives its new supplies in the form of separate materials from which can be built up the particular kind of protein contained in the tissue in question.

Only to a certain very limited extent may any animal tissue be built up from any other products than the

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[20] McCollum, *op. cit.*, p. 82.

particular amino acids of which it is composed. Apparently at least two of the amino acids may be constructed in the organism either from other protein products or from the reconstruction of a part of the protein molecule from its waste nitrogenous portion and from carbohydrate.[21] It is known also that an abundance of carbohydrate in the diet saves the protein from being used up as rapidly as it otherwise would be. Its influence in thus offsetting the breakdown of the protein in the body is quite appreciable.[22] There is no evidence as to whether the simpler carbohydrate is actually made a part of the protein molecule or whether it merely saves the using up of a portion of the existing protein molecules. The result in either event is the same; the final using up of protein is diminished. As a rule, however, the upbuilding and maintenance of the protein components of the tissues of the body must be based upon similar components supplied in the food.

As early as 1897 Rubner wrote that the question of one protein minimum would never be solved because there are many protein minima depending upon the type of food from which the protein is drawn.[23] As Kellogg and Taylor described the matter in 1917: "The amount of protein required in the diet depends upon two variables; (1) Upon the intensity of wear and tear and upkeep in the particular animal concerned; and (2) upon the nature of the proteins of the diet, whether balanced or unbalanced. With a particular animal, if the diet contains balanced proteins a much smaller amount will be required than if the diet contained only unbalanced proteins. In general,

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[21] Bayliss, *op. cit.*, p. 255.

[22] Sherman, *op. cit.*, pp. 210-217; Bayliss, *op. cit.*, p. 269; Starling, *Principles of Human Physiology*, p. 681.

[23] V. Leyden, *Handbuch der Ernährungstherapie* (1 Aufl., 1897), s. 197 (taken from *Archiv für Anatomie und Physiologie*, 1909, s. 210).

less protein of animal origin is required to maintain equilibrium than with the use of plant protein." [24]

MEATS FURNISH MAN A SUPERIOR TYPE OF PROTEIN

This brings us to the real question of the comparative value of meats in the diet in so far as the building of bodily tissue is concerned. Since there are several bases on which this question may be worked out, and since no one method of working out any problem is, as a rule, beyond criticism, the results of several totally different methods of attack on the problem will be given.

It is quite customary in certain schools of this science to base conclusions largely on experiments with rats. It is argued, and apparently perfectly validly, that this method, allowing as it does of the observation of effects of experimentation on several generations throughout the whole life cycle, very much more than offsets the physiological differences between men and the rat.[25] Some object, however, to too sweeping conclusions from such experiments alone. The rat possesses an unfortunate ability to thrive distressingly well on nourishment perfectly out of the question as a human food. While against this it may be argued that proof of negative results with rats will be unquestioned—that, if a rat fails to thrive on a certain food or mixture of foods, man has little chance of success—it will probably be more convincing to most readers if some of the proofs at least come from human experience.

McCollum writes in a recent work,[26] after discussing the results of many different types of experiments, "The work reviewed clearly establishes that the nutritive value of proteins is determined by their yields of the eighteen

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[24] Kellogg and Taylor, *op. cit.*, p. 111.
[25] McCollum, *op. cit.*, p. 9.
[26] *Ibid.*, p. 85.

or more amino acids which are formed on digestion. The more nearly these proportions correspond to the content of amino acids in the tissues of the growing animal, the more effectively can food proteins be transformed into body proteins.'' This conclusion is but natural, since it is evident that the building up of body proteins is accomplished in the long run only from the ''building stones'' of the food proteins. An excess of any particular amino acid would appear to be useless for tissue formation. On the other hand, a shortage in the diet of one of those which are essential and frequently limited in amount would appear to scale down the usefulness of all the others in proportion.

Since the proteins of animal origin are, as a rule, more like those of the tissues of the human body than are others, the strong presumption is in favor of regarding these animal proteins as more valuable for human nourishment than are the vegetable proteins. The most extreme experimental support for this theory—support even to its logical conclusion—indicates that the proteins from the bodies of the same species are the most superior for nutrition. This cannibalistic idea was tried out with dogs as subjects in comparing the nutritive value of proteins from various sources in their diet. First place in nutritive value was accorded the proteins from other dogs, while proteins from wheat and hempseed were of the lowest value.[27]

One of the most illuminating nutritional experiments was conducted under the guidance of the eminent German authority, Rubner, by Karl Thomas. These experiments were based on human experience and were planned to determine the different value for human nutrition of various proteins of animal and vegetable origin. On a diet containing an abundance of other food elements and

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[27] L. Michaud, ''Beitrag zur Kenntniss des physiologischen Eiweiss minimums,'' *Zeitschrift für physiologische Chemie,* Vol. LIX (1909), p. 405 (taken from McCollum, pp. 66 and 87).

practically no other protein, he investigated how much of each of the various proteins must be added to the diet in order to prevent any loss of tissue protein. His method involved the consideration of the balance between the intake of nitrogen with the food and the loss in the bodily excretions. Each of the several proteins was used until the intake and the loss were approximately equal, or the nitrogen "balance" was established. The following table shows his final conclusions.[28]

BIOLOGICAL VALUE OF PROTEINS OF VARIOUS FOODS

Beef	104.74	Crabmeat	79.15	Nutrose	69.02
Cow's milk	99.71	Potatoes	78.89	Spinach	63.83
Cod fish	94.46	Cherries	78.57	Peas	55.73
Rice	88.32	Yeast	70.52	Wheat flour	39.56
Cauliflower	83.88	Casein	70.14	Corn meal	29.52

These results are quoted with full approval by the eminent English physiologist, Sir Ernest Starling, who bases his conclusions upon them as to the comparative value of animal and vegetable proteins. They have been criticized on the grounds of the shortness of the experimental period. However, as we shall show later, the most recent experiments conducted along totally different lines give substantially the same results. The length of time employed, moreover, was apparently ample, for the question of nitrogen balance to be pretty thoroughly established. Excepting in the case of egg albumin, the influence of the consumption of protein upon the bodily nitrogen balance is practically complete at the end of three days.[29] Starling's conclusion based upon this study is that "animal protein is more economical than vegetable protein."[30] On this and

[28] Karl Thomas, "Ueber die biologische Wichtigkeit der Stickstoffsubstanzen in verschiedenen Nahrungsmittlen," *Archiv für Anatomie und Physiologie*, 1909, s. 268-279.

[29] G. Lusk, *The Science of Nutrition*, pp. 152-170.

[30] Starling, *Principles of Human Physiology*, pp. 692-699.

other studies he bases the following more elaborate conclusions.[31]

As regards protein, numerous researches have shown that this substance *can* be reduced far below the amount at present in the average diet. Of the protein taken in the food, a certain proportion is necessary for making good the wear and tear of the tissues of the body. For this purpose between 30 and 40 grams a day would probably suffice, *provided that the protein is of a proper constitution.* This saving clause is extremely important. There is a wide divergence in the composition of different proteins. Vegetable proteins differ considerably in composition from animal proteins, and these in their turn are variously constituted according to the organ or part of the body from which they are derived.

In the process of digestion the protein molecule is dissociated into its constituent amino-acids. These are absorbed into the blood, and each cell takes out such amino-acids, and in such proportions, as are necessary for its re-integration. All the amino-acids, which are not required for repairing waste or for building up the body, lose their nitrogen, which is excreted as urea in the urine, and are then burnt up to furnish energy for the body. It is evident then that, to supply a certain loss of body protein a larger amount of vegetable protein will be necessary than of animal protein such as that of meat or of milk, since some of the amino-acids are present in the vegetable protein in a larger amount than is required to build up animal protein. The excess will be simply burnt up and serve to furnish energy to the body.

Thus we cannot assume that the minimum requirements of protein, as ascertained by experiment, apply to all kinds of protein or even to the total proteins present in a mixed diet. The minimum amount of the most suitable protein required by the average man per day being 35 to 40 grams, it is advisable to double this figure and to assume 80 grams as the minimum quantity which should be provided in a mixed diet. It should also be laid down that a portion at any rate of this protein should be of animal origin.

The Food Committee of the British Royal Society, of

[31] Starling, *The Feeding of Nations,* pp. 61-62.

which Starling was chairman, decided upon 100 grams of protein as desirable. Regarding the conclusions of the latter he says: "In view of the great preponderance of vegetable food in the food of the poorer classes, the Royal Society has laid down 100 grams as the minimum amount of protein which should be aimed at."[32]

Two leading American authorities, Osborne and Mendel, have concluded very elaborate experiments in the field of nutrition. Unfortunately for our purposes their studies have been conducted mainly with purified single proteins taken from various sources rather than upon the nutritive effects of the groups of proteins as they occur in natural foods. It should be noted not only that various single proteins contain varying proportions of their "building stones," the amino acids, but that these single proteins are grouped together in the natural foods so that each food contains more than one single protein. The work of Osborne and Mendel shows a greater relative value of proteins of animal origin than those of vegetable origin as a basis for growth. Gelatin, which is derived from the skeletal tissues, is universally accepted to be an exception to the rule. Zein, the chief protein of corn, is wholly lacking in three of the important amino acids and not only will not support growth when fed as the sole protein, but even mice will die in two weeks on such a diet.

McCollum and his fellow workers have done some valuable work in determining the relative values of groups of proteins as they occur in the chief natural foods and even advance evidence as to the value of combinations of certain natural foods as protein sources. Their findings, in general, agree with the work of Osborne and Mendel and while more far-reaching in their scope, to a very high degree substantiate the earlier findings of Thomas derived by a simpler process.

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[32] *Ibid.*, p. 64.

McCollum, speaking of the work conducted by himself and his associates, says: "The results showed that the quality of the proteins of the seeds of wheat, maize, oats, rice, pea, bean, flax, millet and kaffir corn is such that, when fed at planes of intake that can be secured by including in the diet as much of the seed as possible the optimum condition of nutrition is not attained, even though all other factors in the diet are so adjusted as to be fairly satisfactory. When the latter conditions were fulfilled, the nutrition of the animals could in all cases be improved by the inclusion in the diet of a pure protein such as casein.[33] Again he states: "Among the cereal grains, wheat easily stands first in the quality of its proteins. There is little reason to attempt to place rye, maize, barley, flaxseed oil meal, rolled oats and kaffir corn in their order of values as the sole source of nitrogen in the diet. All that can safely be said is that barley and rye appear to be slightly better than the other seeds named."[34]

Wheat as an entire grain ranks the highest among cereals as the source of valuable protein. Unfortunately for the diet of those nations which use wheat, it is almost universally consumed in products made from bolted flour. This flour contains only a part of the grain and lacks some of its most valuable proteins. The proteins of the flour are practically limited to two, both of which are very unlike any of the proteins in the animal body from the standpoint of their yield of amino acids, nor are they so constituted as to supplement each other's deficiencies. They are, consequently, low in their biological value.[35]

When the various cereal grains are fed together as the sole source of protein they fail to supplement each other's deficiencies to any marked degree.[36] Thus, cereal proteins,

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[33] McCollum, *op. cit.*, p. 84.
[34] *Ibid.*, p. 108.
[35] *Ibid.*, pp. 124-127.
[36] *Ibid.*, pp. 109, 110.

singly or combined, are insufficient to supply the bodily needs properly for tissue formation.

Peas and beans have been heralded far and wide as valuable sources of protein. They are called "the poor man's meat." Evidently this statement would read more correctly with a slight rhetorical change, making the adjective "poor" apply to the so-called "meat." It is perfectly true that they are very rich in protein, but these particular proteins, while appearing on chemical analysis to be fairly similar to animal-tissue proteins, are for some unknown deficiency relatively low in their nutritive value. McCollum shows that these proteins are distinctly poorer for the purposes under discussion than even those of the cereal grains.[37]

In some cases cereals and legumes fed in combination give satisfactory results; thus peas and whole wheat fed together are satisfactory while peas and corn are quite imperfect. Another grain combination which happens to be sufficient is that of rye and flaxseed oil meal when fed together.[38] Since the latter can hardly be expected to fill much of a place in the human dietary, this chance combination need not be emphasized.

Thomas placed potato protein in a fairly high rank. McCollum classes it below that of the cereals for the support of growth. He does, however, concede the possible validity of experimental results found by others,[39] pointing to a fairly high value for this protein in replacing the wear and tear of the tissues of adults. In this he admits the possibility of a different biological value of proteins for growth and for adult maintenance claimed by Osborne and Mendel and others.

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[37] *Ibid.*, pp. 45, 132, 133.

[38] *Ibid.*, pp. 109, 110.

[39] *Ibid.*, pp. 138, 139; M. S. Rose and L. F. Cooper, *Journal of Biological Chemistry*, XXX (1917), p. 201; M. Hindhede, *Eine Reform unserer Ernährung* (1908).

In direct contrast with this low biological value of the chief vegetable proteins, when fed in the single foods supplied by nature or in their ordinary combinations, stands the high value of proteins of animal origin. Gelatin is the only important exception. Eggs, milk, meats and the edible glandular tissues, such as liver, all rank as excellent tissue builders either alone or as supplements to vegetable proteins. All available evidence goes to show that in the order in which they are placed above they stand in an increasing scale of value. The protein of eggs is of very high rank. Unfortunately, however, it seems to be particularly subject to putrefaction in the alimentary tract.[40] The peculiar value of eggs in combination with other things in successful cookery gives them their unique place in the human diet.

The proteins of milk, when taken in combination, take the high rank in biological value which we should expect in a product designed by nature as the sole food of the very young of all mammals. There is, of course, some difference between the milks of various species, but cow's milk, with more or less modification and when due care is taken in handling it, is well suited to the needs of almost all human infants.

The evidence presented by leading authorities, however, places the proteins of meat slightly above those of milk for the requirements of all but infants. Professor McCollum states in his recent work on the *Newer Knowledge of Nutrition* that "it is of great interest that recent investigations, which were sufficiently extensive to make them conclusive, have shown that the proteins of muscle, liver and kidney, are in general more valuable for enhancing the values of cereal and legume seeds than are the proteins of milk."[41]

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[40] McCollum, *op. cit.*, p. 152. [41] *Ibid.*, p. 150.

It will be noted that this agrees very closely with the findings of Thomas who found that as single sources of proteins beef stood about 5 per cent higher than even milk. An interesting comment on the biological value of milk for human adults comes from the prominent German physiologist, von Noorden. It must be remembered that most of the American experiments are made on the growth of young rats and we may expect some slight differences in the case of adult human beings. Von Noorden points out that "cow's milk is utilized very unequally by adults, and usually much less completely than it is by sucklings."[42]

There is evidence that the proteins of the glandular organs, such as liver and kidney, are superior to those of the muscular tissue which we ordinarily eat.[43] When we consider the comparative palatability of real meat and these organs in the taste of the rank and file we must concede that any slight advantage of the latter as a source of protein is more than offset by their palatability.

Professor MacLeod sums up the situation in the following words: "It is therefore apparent that the most valuable proteins will be those that contain an array of units that can be reunited to form all of the varieties of protein entering into the structure of the body proteins. Naturally, the protein which most nearly meets the requirements is meat protein."[44]

We may, accordingly, safely conclude that meat holds a peculiarly high place as a source of protein.

The extent of the superiority of the value of meat for tissue formation may best be brought out by referring to the quotation from Sir Ernest Starling on page 14, remembering that meat is *par excellence* the source of animal pro-

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[42] Carl von Noorden, *Metabolism and Practical Medicine*, translation, p. 54.

[43] McCollum, *op. cit.*, p. 148.

[44] J. J. R. MacLeod, *Physiology and Biochemistry in Modern Medicine*, p. 607.

teins. His statement indicates that animal proteins alone are of twice the value of mixed proteins containing a portion of the former.

It must not be supposed that protein which is not used for tissue formation is necessarily wasted. The excess over needs for construction purposes is used for energy production. It serves to produce heat and perform work in a manner similar to the use of carbohydrates and fats. In quantity of energy value it is the equal of the former, although there are considerable differences between the effects of the two in the body. There seems, however, to be no real value in protein as an energy producer over carbohydrate and it is distinctly poorer in this regard than the fats. When we consider the greater cost of protein, it seems impossible to support the view that any unnecessary consumption of it beyond what is needed to assure the optimum tissue maintenance is desirable. As far as it is a surplus product, either as a type of low biological value in the cereals which we consume for their other forms of nourishment, or as an excess of the unnecessary types consumed with foods consisting in the main of the more valuable proteins, its consumption is not from choice and we need not discuss its cost. Suffice it to say that such a by-product can be used, when present, with approximately similar value to that of carbohydrates. It is, however, worth while to consider the question of the desirability of any further consumption of protein taken deliberately for energy production in excess of such fortuitous intake as we have described. As a rule protein is high in its purchase price and its cost is high in terms of the process required to produce it. For energy production it may more cheaply be displaced by non-nitrogenous foods.

The evidence leads to the conclusion that man would be better off to use those proteins which are best fitted to

their peculiar use for the bodily tissues. These are chiefly the proteins of animal origin. Vegetable proteins in the diet, in so far as their "biological value" is low would seem to be of lesser value than the animal proteins.

THE IMPORTANCE OF FAT IN MEATS

Meats, as a rule, contain a larger proportion of fats than is commonly supposed. Pork in the United States and in Germany is largely fat. In England a leaner variety is more popular. In contrast with these national differences is the interesting fact that beef and mutton in England normally contain a larger percentage of fat than these meats have on the Continent.[45] In any case the fat content is usually high.

Part of this fat is in special tissues either directly under the skin or around the visceral organs. Excepting in the case of hog fat, these special fatty tissues are seldom consumed with the meat. Much of them is saved in the slaughter houses and prepared for cooking fats or oleomargarine, but such fats as are purchased by the consumers with their cuts of meat are all too frequently wasted. There is, however, a very large amount of fat in the muscular tissue of meat either distributed in small portions between the fibers or in the cells themselves. Starling gives the percentage of fat in butcher's meat in England as higher than that of protein.[46] It is well known that the fattening process which gives to beef the quality known as "marbling"—*i.e.*, intermingling of the muscle tissue with adipose tissue—also increases the quantity of fat in the muscular tissue itself.[47] It is not so well known that the muscle of even the heart in normal condition may

[45] Commission Scientifique Interalliée du Ravitaillement, *op. cit.*
[46] Starling, *Principles of Human Physiology*, p. 701.
[47] W. A. Henry and F. B. Morrison, *Feeds and Feeding*, p. 83.

contain as much as 17 per cent of fat.[48] Fat is the ultimate form of the storage of fuel in the body, but it also assumes a different form. Fats in complex combinations of still unknown composition represent essential structures in cellular protoplasm, all membranes, and in the central nervous system. Much is known concerning fat as fuel, but little concerning fat in cellular structure.[49] It is thus evident that when we eat what we call lean meat we may be consuming far more fat than we realize.

It is theoretically possible for man to live without fats in his diet. These products can be produced in the body from the starches and sugars of the carbohydrate diet. It would hardly seem economical for the human body to be called upon to do this to any large extent since it requires a decided "step-up" or transformation of energy to a higher plane, these fats having twice the energy concentration of the carbohydrates. More than two grams of the latter would, accordingly, be required to produce one of the former. Since nature has provided us with an abundant proportion of fats in animal carcasses, it would seem more economical for us to procure our fats ready-made, provided the comparative cost is not too great.

There are several other facts pertaining to the digestion and assimilation of foodstuffs which make it highly desirable that at least a fair share of man's energy-producing food should consist of fats. One of these facts is that fats are less subject to fermentation changes in the digestive tract than are the sugars and starches. Another is that fat takes up far less room both during digestion and in the fluids and tissues of the body itself than do the carbohydrates. Starch when ordinarily prepared in food is swollen with five to ten times its amount of water and can only be eaten mixed with large quantities of saliva. Even

[48] Starling, *Principles of Human Physiology*, p. 826.
[49] A. E. Taylor, *Digestion and Metabolism*, p. 342.

after absorption the same necessity for a watery dilution persists. Even in its point of greatest concentration, the liver, it only rises to 12 per cent, as compared to 80 per cent of fat in adipose tissue. Carbohydrates in the circulation and muscular tissues appear largely as sugar, and this requires twenty times its weight of water to carry it. Just as in the case of common salt, in certain circumstances, including a shortage of fats in the diet, an excess of carbohydrates may produce actual dropsy. Fat, on the other hand, not only has double the energy of other foods per unit of weight, but it may enter the human system in a pure form without admixture. Since the human alimentary canal is small, this question of bulk assumes great importance for our diet. As Starling says, "The human alimentary canal (at any rate, in our race) has been developed so as to cope with a diet in which 20 to 25 per cent of the energy is presented in the form of fat."[50]

Another digestive feature, making it important that a fair proportion of our food should be fat, is the fact that fat is digested more slowly than are other foods. This may sound surprising in view of the comparative value popularly ascribed to some foods which have been found to be so easily digested by invalids and children. For the adult, especially at hard physical labor, there is an advantage in food that, while not indigestible, is not too rapidly absorbed. The greater part of the carbohydrate in food is absorbed in about three hours after it is eaten. If there is no fat in the diet it is poor in "staying power" and the feeling of hunger results with diminished working efficiency. An interesting example of this is related of men in railway construction work in Canada. Part of the men who were Italians were found to become very in-

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[50] Starling, *The Feeding of Nations,* pp. 66-74.

efficient about three or four hours after eating. Their Canadian fellow workmen could continue on the job until the next meal. It was found that the Canadians were consuming large quantities of fat meat, while the Italians economized on this expensive side of the diet. On the company's insisting that the Italians adopt a diet comparable to that of the Canadians it was found that the Italians could keep up their work perfectly well. They had found it difficult to work on the empty stomachs which resulted from their formerly comparatively fat-free diet. Comparable experience, particularly among the miners, was noted in England during the war days when fat supplies were low. The few months in 1918 when there was a deficiency of fat is said to have been the only occasion on which food shortage caused a serious inconvenience to the British during the war.[51]

The war experience of Germany in respect to shortage of fats is most illuminating. A committee of their ablest scientists in the early days of the war computed the food needs of the nation. They laid too little stress upon the necessity for fats, and led the German people to believe that they could get along with far less of this foodstuff than they normally consumed.[52] It is generally supposed that the lack of this food was one of the great causes in breaking down the morale of the German people in the last year of the war.

The necessity for foodstuffs other than the three main classes, proteins, carbohydrates and hydrocarbons, has already been pointed out. According to present knowledge, the only products of this kind which may be unduly limited in the diet, when there is a sufficient quantity of food in general, are mineral salts and what are popularly known as vitamins.

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[51] *Ibid.*, p. 66.
[52] Report of Eltzbacher Committee.

THE MINERAL REQUIREMENTS IN MEATS

Meats are apparently better supplied with a wide range of the essential food materials than almost any other food, excepting some which are greatly diluted with water. However, meat does not contain any important supply of carbohydrate and it is not a rich source of supply for all mineral salts, nor does it stand in the first place as a source of certain of the vitamins. When we consider the possible dangers of a monotonous diet, it will be conceded readily that nature made no mistake when she failed to supply man with any one single complete food. The Eskimos live chiefly on meat and fish, but consume many parts of the carcass which a civilized man would not eat. They also eat the half-digested moss from the stomach of the caribou, thus supplying themselves with vegetable matter.[53] Milk is the product which is the nearest to being a complete food in itself and even cow's milk alone will not support life in a calf up to six months of age. The Iowa Agricultural Experiment Station attempted to raise calves on nothing but milk and common salt. Death resulted within six months with signs of extreme malnutrition.[54] The carnivorous animals find a complete food in the whole bodies of their prey when they consume the blood, viscera and bones along with their meal. Man is not looking for such a diet and is well satisfied to find in meat so many qualities of excellence which can be enjoyed in combination with other foods.

The mineral requirements of the diet are fairly wide. Fortunately, the supply of most of these requirements is ample in an ordinary diet which includes common salt.

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[53] D. Jenness, *The Life of the Copper Eskimos,* Report of the Canadian Arctic Expedition, XII (1913-18), pp. 97-109.

[54] A. C. McCandlish, *Research Bulletin,* No. 48, Iowa Agricultural Experiment Station.

Fifteen chemical elements are known to be essential to human nutrition. Three of these, carbon, hydrogen and oxygen, as we have seen, are in all the ordinary foodstuffs. Two others, nitrogen and sulphur, are always present in all proteins, and nearly all proteins contain some phosphorus.[55] The nucleins and certain fatty combinations found in the tissues also contain phosphorus. Of the remaining nine elements, two, sodium and chlorine, are taken in ample quantities in common salt. Iodine, fluorine and silicon are required in very minute quantities. Of these, the lack of iodine seems to assume important proportions. The knowledge on the subject of iodine in the diet is very limited as yet and it is impossible to discuss its relation to various foods. The remaining essential minerals are potassium, magnesium, iron and calcium. Of these, potassium and magnesium are relatively abundant not only in meat but also in most plant tissues.[56] Iron is very important as a bodily constituent. There is a question as to whether or not it is possible for the body to make good use of this element in inorganic form, as it frequently has been supplied in cases of anæmia. However, it is relatively abundant for nutritional needs in many foods including meats, eggs, grain and vegetables, although not in milk.

Calcium is also a very important element, especially during growth. Its efficient utilization in the body apparently depends upon vitamin action or an abundance of light. Since the bones contain so large an amount of this material, the body contains about 2 per cent of it, which is a larger proportion than that of any other of what are called the mineral salts.[57] Unfortunately, calcium is not abundant in most diets. Milk and leafy vegetables

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[55] Starling, *Principles of Human Physiology*, p. 71.
[56] Sherman, *op. cit.*, p. 261.
[57] *Ibid.*, p. 262.

contain the highest proportion among ordinary foods.[58] Meats as they are consumed by civilized man cannot be regarded as an important source of calcium, although, as will be shown later, they contain vitamins which aid in the utilization of this element.

It is thus evident that in the case of the mineral salts which the body needs, excepting in the case of calcium, meat as it appears in the diet of civilized man supplies its fair share. Whether or not this latter element may readily be supplied as needed from other sources, including inorganic calcium, if the proper vitamins or equivalent are present, is a point on which leading scientists do not agree.[59]

MEATS AND VITAMINS

The importance of the substances known as vitamins in the diet has been emphasized only during the past few years, although the Japanese had known for a considerable period that the removal of the outside of the rice kernel produced a disease and the British navy had learned of the deficiency disease of scurvy and its cure over a century ago.

No one has as yet discovered exactly what these vitamins are. They apparently originate in the plant tissue along with the common foods under the influence of sunlight and can be obtained by man through either animal or vegetable food. Recent studies seem to have established it as a fact that sunlight may produce a direct effect in the human body similar to that of at least one class of vitamins.[60] The supposition is that they are used

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[58] *Ibid.*, p. 269; McCollum, *op. cit.*, p. 149.

[59] Von Noorden, *op. cit.*, p. 38; Sherman and Hawley, "Calcium Requirements of Children," *Journal of Home Economics* (September, 1922), pp. 413-415.

[60] Steenbock and Daniels, "Irradiated Foods and Irradiated Organic Compounds, Therapeutic Possibilities," *Journal of the American Medical Association*, April 11, 1925, pp. 1093 *ff.*

neither for tissue formation nor energy production but for the regulation of the chemical reactions within the body. Starling and Bayliss class them as "hormones," or messengers, along with the products of certain living glandular organs which appear to govern chemical reactions in another organ or perhaps throughout the whole body.[61]

There are three or four different vitamins according to the ideas on the subject accepted to-day. Vitamin A is fat-soluble and appears to be indispensable for growth and necessary for the prevention of certain diseases. Vitamin B is water-soluble and also promotes growth and prevents certain diseases. Vitamin C is also water-soluble and is of value in preventing scurvy. Some authorities set off a fourth, vitamin D, perhaps not clearly distinguishable from vitamin A, which is an active principle in the prevention of rickets. It is being suggested recently that there are still others.

Needless to say, since man has lived for many ages and the knowledge of these substances is a comparatively new thing, the occurrence of these vitamins in man's natural diet is fairly widespread. It does seem to be true, however, that the natural food of most uncivilized men is better supplied in this regard than is the food of modern civilization. Man may be paying fairly heavily for some of his civilized ways of eating, but it would seem that modern people whose economic status permits the purchase of sufficient food ordinarily eat a sufficient variety to supply an ample amount of these food essentials.

The fresh leafy vegetables appear to be one of the leading sources of supply of all these vitamins in the normal modern diet.[62] There is also reason to suppose that the vitamins in foods of animal origin ultimately come largely

[61] Bayliss, *op. cit.*, p. 706; Starling, *op. cit.*, p. 693.
[62] Eddy, *The Vitamine Manual*, pp. 56-61.

from the grass and other green fodders of the animals, for cow's milk certainly loses its value as a source of these products when the cows are deprived of their green feed.[63] Since man's digestive system is not, as that of the cow, suited to utilizing large quantities of these vegetable products, which contain valuable elements but only small food value per unit of bulk, it need hardly be expected that man will derive all his vitamins direct from the leaves of vegetables and from fruit.

Foods of animal origin are normally important sources of vitamins. The animals obtain these products from their feed and render them available for human use in the milk, eggs and animal tissue of our foods. Milk was the earliest discovered source of these products in the laboratory and perhaps this fact has been of paramount importance in unconsciously influencing even some of the scientific minds to assign to dairy products a relative position as a source of vitamins even higher than the excellent one which they undoubtedly hold and to condemn the meats without a fair hearing, even before any semblance of a hearing in the case of some meats.[64] Milk is such a valuable food that it needs no misrepresentation of other foods to advertise its own value.

The vitamin content of meat is thus described by Funk: "The significance of meat as a component of our diet is threefold. First, as an important source of protein, second, as a source of vitamines when it is used as a sole food; and third, for its vitamine sparing action. In accord with our own experience, we know of no single food which requires so little vitamine addition as does protein material, especially meat. . . . According to Osborne and Mendel dried meat contains sufficient vitamine A."[65] If this be

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[63] McCollum, *op. cit.*, pp. 335, 344; C. Funk, *The Vitamines*, p. 256.
[64] Bulletin 1138, U. S. Department of Agriculture (1923).
[65] Funk, *op. cit.*, p. 262.

true of dried meat, subject to considerable oxidation which is destructive of this vitamin, fresh meat should be an excellent source of this element. Meat has been reported by some writers as deficient in vitamin B, although all agree that this is found abundantly in the internal organs such as liver. Research workers in the United States Department of Agriculture have very recently shown that pork is fully as rich in this element as even the glandular organs of cattle and sheep,[66] which are admitted to be excellent sources of vitamin B. There appear to be no records of previous experiments on the vitamin content of the flesh of the pig, beef and horseflesh being usually employed exclusively in drawing conclusions as to meat.[67] This lack of complete investigation in the field of meats is one cause of prejudiced ideas as to their vitamin content. Meats have been widely condemned in this respect without a fair hearing. The custom of drying the meat before experimentation must also vitiate the results to a large extent for vitamin A, which is easily destroyed by oxidation. The fat of meats, which, as we have seen, is a large proportion of meat as it is eaten, is admitted generally to contain vitamin A. There is a difference of opinion regarding prepared lard.[68]

Halliburton and Drummond wrote in 1917: "The fat-soluble accessory growth substance is present in beef fat and oleo oil and is present in margarine prepared upon such a basis. Such margarines are nutritively the equivalent of butter."[69]

Steenbock, Sell and Buell wrote in 1921: "In our work . . . the oleo oils from beef fats, prepared in commerce for the manufacture of oleomargarine, were in some in-

[66] Bulletin 1138, U. S. Department of Agriculture (1923), p. 46.
[67] *Ibid.*, p. 2.
[68] McCollum, *op. cit.*, 145.
[69] Halliburton and Drummond, *Journal of Physiology* (1917), Vol. 51, p. 250.

stances found richer in the fat-soluble vitamines than many butters." [70]

The British Medical Research Committee, reporting on the vitamins in various foodstuffs, ranked mutton and beef fat or suet equally with cream as a source of vitamin A, ranked lean meat (beef, mutton, etc.), equally with milk in content of B and C and placed it among the substances which contain vitamin A in appreciable measure, at the same time showing none of this latter in skim milk.[71]

It should be pointed out in this connection that meat is also of value in the cure or prevention of other diseases which seems to be due to a deficiency in the diet. Rickets is an all too common ailment with children even when fed on the mother's milk. Mellanby gives evidence that meat and a water extract of meat acted to prevent this disease in the case of experiments with dogs.[72] Pellagra is also a deficiency disease due to a faulty diet, although there is no proof, at least as yet, of the relation to any vitamin. It is very serious among large population elements depending too largely upon corn meal in the diet. The inclusion of fresh meat in the diet has been found one of the means of prevention and cure.[73]

There is, very evidently, no deficiency in meat, as it is ordinarily eaten, in regard to its vitamin content.

OBJECTIONS WHICH ARE RAISED TO THE USE OF MEAT

Many questions have been raised as to the possible evil consequences of meat in the diet and the theoretical pos-

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[70] Steenbock, Sell and Buell, *Journal of Biological Chemistry* (1921), Vol. 47, p. 97.

[71] Medical Research Committee Report, *The Present State of Knowledge Concerning Accessory Food Factors (Vitamines)*, 1921.

[72] E. Mellanby, "An Experimental Investigation of Rickets," *Lancet*, 1919, p. 407, and 1920, p. 856.

[73] McCollum, *op. cit.*, pp. 278, 290.

sibility cannot be ignored that the good effects of a partial meat diet might be offset by evils. It would appear that all the serious arguments advanced against a meat diet are based upon the effects of an excessive use of this food. We might on this score dismiss the discussion, since no large groups of the modern civilized population consider the use of meat as a sole diet, nor does its price tend to its undue proportion in the food of the masses. Excess of eating in the case of any one food or all foods is condemned by all physiologists. The ideal of civilization is a wide variety of foodstuffs and moderation in eating.

It was at one time customary to lay the cause of gout to the use of meat. This idea was based upon the idea that uric acid formed in the utilization of proteins in the human body was responsible for the deposit of urate of sodium in the joints, which constitutes gout.[74] We have already shown that it is nuclein rather than protein which is the source of uric acid and that the nucleins are abundant in glandular organs, such as the liver, rather than in meat. The end product of protein is urea, which Starling characterizes as "an innocuous substance."[75] Lusk writes regarding gout that "clinical experience teaches that the predisposing causes are excessive eating, little muscular exercise, the abuse of alcoholic beverages, and lead poisoning."[76]

The present theory, now largely accepted by physicians, is to connect gouty disturbances and arthritis or rheumatism with infections, such as diseased teeth or their sequel, diseased tonsils.[77] There is also a tendency to connect dis-

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[74] Starling, *Principles of Human Physiology*, p. 824; Lusk, *op. cit.*, p. 351.

[75] Starling, *Principles of Human Physiology*, p. 699.

[76] Lusk, *op. cit.*, p. 351.

[77] L. J. Llewellyn, "On Gout," *The Medical Press*, N. S. III (1920), pp. 411, 430; Billings, Coleman and Hibbs, "Chronic Infectious Arthritis: Statistical Report with End Results," *Journal*

eased teeth with dietary deficiencies and rickets.[78] It would thus appear that the consumption of the protein and vitamins in meat in early life should be of real value to offset the appearance of such diseases rather than a cause of these disorders.

Various other arguments against meat eating arise from various quarters. Professor Irving Fisher conducted experiments on meat eaters and non-eaters and came to the conclusion that the meat abstainers had greater strength and endurance than the meat eaters.[79] There is no assurance, however, that the strength was caused by the abstinence from meat. It may just as easily be that the particular abstainers in question were naturally of superior strength and that it was this native strength that made them less in need of meat than more normal individuals. All the racial evidence available indicates that the ordinary meat-eating races are the most virile races of the world.

The contention that protein is injurious because of the effect of its waste products in the body has received more or less acceptance and, on the other hand, is vigorously disputed by leading authorities. Chittenden and his followers base their arguments for a diet relatively free from protein on this theory.[80] Starling refutes one phase of the theory in the following brief passage: "Some authorities have recommended the diminution of protein to the mini-

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of the American Medical Association, April 15, 1922, pp. 1097-1105; Pemberton and Robertson, "Studies on Arthritis in the Army, Based on Four Hundred Cases," *Archives of Internal Medicine,* 1920, pp. 231-282, 335-404; R. Pemberton, "The Nature of Arthritis and Rheumatoid Conditions," *Journal of the American Medical Association,* December, 1920, pp. 1759-1764; W. S. Sadler, *Americanitis, Blood Pressure and Nerves,* pp. 22, 100.

[78] McCollum, *op. cit.,* p. 323.

[79] I. Fisher, "The Influence of Flesh-Eating on Endurance," *Yale Medical Review,* March, 1907.

[80] R. H. Chittenden, *Physiological Economy in Nutrition* (1904), p. 459.

mum amount on the idea that the kidneys and other organs may suffer from the strain of eliminating excess of nitrogenous waste products. But the energy metabolism of protein results almost entirely in the formation of urea, an innocuous substance, which can have little harmful effect on the kidneys, even if we make the unjustifiable assumption that these organs, unlike other organs of the body, suffer as a result of their normal functional activity. There is no doubt that many of the disorders of middle life may be put to overfeeding and lack of muscular exercise, but there is just as much reason to ascribe these evils to the carbohydrates as to the proteins of the diet. Indeed, it has been found that for men leading a sedentary life a moderate protein and fat diet is more suitable than one consisting of carbohydrates.'' [81]

Whether or not the acidity of the end products of meat is injurious is more a subject of debate to-day. Opinions are far from unanimous on this subject and in the varied diet of modern life we eat so many other foods whose end products are alkaline and neutralize any possible tendency to harm that it cannot be conceded that any case has been proved against general meat consumption. It is probable that meat, as indeed any other class of food, is injurious in the case of people suffering from certain maladies, although meat seems not to be so universally dangerous for all sufferers of any disease as are starches and sugars in the case of certain kidney disorders. Overeating of food in general is responsible for troubles frequently blamed on meat in particular.[82]

One of the most interesting pseudo-scientific attacks on the use of meat on the score of health is that made fairly recently by a prominent life-insurance statistician who

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[81] Starling, *Principles of Human Physiology*, p. 699.

[82] W. S. Sadler, *Americanitis, Blood Pressure and Nerves*, pp. 21-28, 110.

claims to have established a connection between meat eating and high blood pressure.[83] He shows that the blood pressure in the United States was low during 1917, 1918 and 1919 and gives as a reason the war-time restrictions on the consumption of meat, which he says were "faithfully observed by the mass of the citizenry." The official statistics show clearly that, in spite of the campaign for saving meat, the year 1918 was the peak of a wave in meat eating instead of a time of smaller consumption. The consumption of all meat, excluding lard, averaged 144.9 pounds in 1918, which was higher than in any other year between 1913 and 1922.[84] He also shows that the blood pressure is lower in Argentina and higher in Australia than in the United States and assumes that the meat consumption is responsible. The official statistics of these two countries show that the rate of meat consumption in each is higher than the rate in the United States.[85] He also shows that the blood pressure of Negroes in the United States exceeds that of whites and makes the statement that Negroes "have a reputation for eating heartily of meat." Studies conducted by the United States Bureau of Labor Statistics in the South show that the Negro does not eat more meat than his white neighbor,[86] and studies conducted in Boston under the direction of the present writer show that meat consumption is less among the northern blacks than among the poorer class of their white neighbors.[87] It is evident that other factors besides the diet

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[83] Arthur Hunter, "Blood Pressure; What Affects It?" Address delivered at the seventeenth annual meeting of the Association of Life Insurance Presidents, 1923.

[84] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1014.

[85] See p. 576 *infra.*

[86] *Monthly Labor Review* (U. S.), August, 1919, pp. 1-25.

[87] G. W. Tasker, *A Survey of the Consumer Demand for Meat in the City of Boston, Mass.,* MS. on Files of New England Research Council on Marketing and the Food Supply.

should be looked to for a solution of the dangers of high blood pressure.

WHY MEAT IS A GOOD FOOD

Probably more people eat meat because they like it than for any other reason. Man can live without it, but few civilized men will if they can afford to eat it. The flavor of food is not a negligible factor in its power to nourish. Even those who have denied to meat other virtues which it possesses do not deny the value of its flavor.[88] In discussing the value of meat, Starling writes: "One other fact is of importance in this connection. Meat is not only easily cooked and presented in a palatable form, but its flavor renders other kinds of foods acceptable, at any rate to most inhabitants of the temperate and northern parts of Europe."[89]

We have seen that a certain amount of protein is indispensable in the diet; that the protein of meat is of the highest value for tissue-forming purposes of any of our foods, not excepting milk; that the surplus protein consumed in addition to the tissue-forming needs is valuable as a source of energy—a value peculiarly high in cold weather and for inactive people; that meat contains all the required and limited mineral salts, excepting those of calcium; that it is a comparatively rich source of vitamins; that it is not injurious to health when used in the moderation which should apply to all things; and that men have used it and will use it because they like it for its flavors.

HOW MUCH MEAT SHOULD BE EATEN?

The question then arises as to how much of this food we should eat. Is it a matter of such indifference that

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[88] J. R. Smith, *The World's Food Resources*, p. 173.
[89] Starling, *Principles of Human Physiology*, p. 701.

tastes and purchasing ability alone should dictate? It is easily possible that the average human being under ordinary economic circumstances supplies himself properly with meat. However, there are great variations in the amount of meat eaten in various countries and by various classes of people within any one country. In the newer countries such as Australia and Argentina the per capita consumption is high.[90] In some of the older and more settled countries it is low. Many rich people eat it abundantly and many poor eat it very sparingly. Is there any reason why heavy consumers should be advised against their present habits or that care should be taken to make meat more available to the people in the lower economic strata of the population and that these latter should be taught to exert themselves to acquire more of this diet?

These questions should be approached from the angle of what is the optimum rate of consumption of protein and what part of this protein consumption should be meat. Needless to say there is no unanimity of opinion on these questions.

It is perfectly true that some men have existed comfortably with an abnormally small consumption of protein. So also some have lived in comfort on a relatively small amount of vegetable protein alone. There is a great variation in the food requirements of different individuals.[91] Chittenden first experimented on himself and then on groups of students and soldiers. He reports all the men in excellent condition at the end of long periods of relatively low protein diets. He stated that he felt much better himself for his abstinence. The perusal of the menus on which some of his men were fed, however, fails to im-

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[90] See p. 576, *infra*.

[91] Chittenden, *op. cit.;* Hindhede (1913), "Studien über Eiweissminimum," *Skandinavisches Archiv für Physiologie,* 30 (1913), pp. 97-182; "Das Eiweissminimum bei Brotkost," *Ibid.,* 31 (1914), pp. 259-320.

press with the idea that they were particularly limited in protein or anything else. The data which he publishes on the meals fed to students would compare favorably with the food supplied in many college eating places.[92] The soldiers who persisted in the diet are said to have experienced much benefit therefrom.[93] How much of the benefit was due to the lower protein diet and how much to a greater regularity of life imposed with the experiments, it is impossible to say. Von Noorden suggests that the regularity of life and abstinence from alcohol and other stimulants had a great deal to do with the benefits which resulted.[94] It should also be noted that the men were volunteers for the experiments and so may be presumed to have had peculiar adaptabilities to such a diet and that even among these few volunteers there was the widest variation in reaction to the diet when it was tried. The proponents of a low protein diet point to the happy state of those who completed the experiments. They fail to note that out of twenty volunteers four deserted, five others were transferred out of the detachment for mental, moral or physical reasons and one of these went insane. The insanity of the latter was due, according to the medical officer in charge, to the restrictions imposed in the experiment.[95] Evidently, as von Noorden points out, there is a considerable degree of latitude in the protein requirements of different men.[96]

McCollum emphasizes a very important fact in connection with these human experiments of relatively short duration. His contention is that the longest experiments are too short a period of the normal human life to warrant conclusions at variance with general human experience.

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[92] Chittenden, *op. cit.*, pp. 366-374.
[93] *Ibid.*, p. 286.
[94] Von Noorden, *op. cit.*, p. 301.
[95] Chittenden, *op. cit.*, pp. 132-133.
[96] Von Noorden, *op. cit.*, pp. 282, 301.

He also emphasizes the great difference between a minimum or even normal standard in planning the diet and an optimal standard. He states that it has been abundantly demonstrated in his experiments on animals that "diets which fall far below the standard of quality necessary to maintain life and vigor over a very great fraction of the span of life which the species is capable of living, may cause no noticeable deterioration in the physical condition, during even five per cent of the normal expectation of life." He also shows that these human experiments purporting to show that man might much better reduce his protein consumption never lasted over 1 per cent of the human span of life. They are, therefore, not conclusive as to the best results in the long run.[97] Who is not familiar with the fact that for a brief period a light diet may improve a person's capacity to think clearly, to sing, to speak or perhaps even to do physical work? Many adopt such temporary light diets with benefit and return to the normal when the special occasion has passed.

Starling recognizes that the minimum requirements of protein of the most suitable kind amount to only 35 to 40 grams per day for the average man, but concludes that 80 grams is the lowest quantity which should be provided in a mixed diet and agrees with the War Food Committee of the British Royal Society, of which he was chairman, that 100 grams is the amount which should be aimed at even under war conditions.[98] Probably no jury has ever deliberated on this question which was more competent to pass judgment upon it and which was impelled by more serious motives than this committee appointed by the British government in time of the nation's grave danger from famine.

How this agrees with the actual consumption in representative communities is a matter of interest. The pro-

[97] McCollum, *op. cit.*, pp. 54-56.
[98] Starling, *The Feeding of Nations*, pp. 61-64.

ponents of a high milk diet point out, and rightly, that the average consumption of that food should be higher than the minimum requirements for the individual because many individuals must get along on less than the average. This argument applies to the consumption of meat with equal validity. In 1918 the United States Bureau of Labor Statistics found that the protein consumption in representative workmen's families in various centers throughout the United States varied from 87 grams to 117 grams per day.[99] This would average slightly above 100 grams, but leaves an average for whole communities considerably below that mark. When we consider the fact that the year 1918 was a high point for a number of years in meat consumption in the United States, we see that many communities even in the United States frequently fail in a supply of the optimal amount of protein. Yet the United States ranks high among the civilized nations as a consumer of meat.

It is evident from these facts that civilized man is not as a rule eating too much meat. Some few men may with other intemperate habits be consuming too much of this food. The average man is not too well supplied and many even in the United States and Great Britain are not able to eat the meat they should. In many nations the average consumption is distinctly too low. It is heartening to note that the trend of meat consumption is upward in many of the older countries.

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[99] *Monthly Labor Review* (U. S.), *loc. cit.*

CHAPTER II

THE RELATION OF MEAT TO FOOD PRODUCTION

PERHAPS the most striking factor in the relation of animal husbandry to food production is the large amount of feed required to produce any given quantity of human food in the form of meat. When the animals are fed on the free natural range this factor is of practically no moment. With the passing of these free ranges and the increasing necessity of feeding live stock on grains which might be eaten by man himself, or on crops which might be supplanted by other crops more suitable for human food, this factor presents a real problem. Enthusiasts for animal husbandry have had a tendency to offset it with arguments for the necessity for, or at least great value of, live stock in maintaining the fertility of the soil. The accumulated evidence from the world's leading agricultural experiment stations has made this argument of lessened value; soil fertility can be maintained without live stock. However, soil fertility can be maintained much more readily when animal husbandry is combined with farming, and the conversion of animal feed into human food by no means represents the sacrifice of human food possibilities which the ratio of the amount of feed required to produce animal foodstuffs would appear to indicate. When all phases of this problem are considered, the conclusion seems inescapable that, while there are large inefficiencies in animal husbandry as it is conducted to-day, most of these inefficiencies are unavoidable in our present stage of economic development and will pass as the world's

population grows more dense, but that the animal industries are not inherently inefficient and will probably never be relinquished by civilized man.

THE CHEMICAL PROCESSES OF FOOD PRODUCTION

Food production as conducted on a modern farm is a process of natural forces considerably assisted in their action by the work of the farmer. It has already been pointed out that the chief human foods are carbohydrates, fats and proteins. Of these, the first two are composed solely of hydrogen, carbon and oxygen with the latter present in such a limited proportion that these food products can be combined with more oxygen in the human body, thereby setting energy free for the use of the body. Of these two food products, the fats have the smallest proportion of oxygen and are capable accordingly of setting free a larger amount of energy when oxidized in the body. Proteins are more complex substances, having nitrogen and several other elements combined with the elements in the other two classes of foods. All three classes contain stored-up energy which they give off in the vital processes of the human or other animal body. In the animal body food substances lose their energy through oxidation and break down into simpler chemical combinations. The fundamental process of food production in agriculture is the building up of these complex chemical combinations with their stores of available energy.

This process of building up food substances is one of purely natural forces. The stored-up energy comes from the sunlight. The carbon comes from the carbon dioxide in the air. The hydrogen comes from the water in the soil and air. The oxygen is present in superabundance in both water and carbon dioxide and the process of making carbohydrates consists in taking these latter and com-

bining them while setting free into the air part of the oxygen. This process of setting oxygen free goes on in the green matter, called chlorophyl, in the leaves of the plants. Thus the plants store up the sun's energy in carbohydrates by setting oxygen free, while the animal body gets energy from the resulting substance by combining it with oxygen. The carbon dioxide which the plants use comes from the air, which gets it in turn from that given off by animal bodies while their food is being oxidized and also from the rapid burning or slow oxidation of organic products which is going on all around. Thus food production in the plant and food utilization in the animal body are two parts of a continuous cycle of chemical change in which the sun's energy is taken up in the plant and given off in the body.

The production of fats and proteins in the plant tissue involves added processes in the production of food. In the formation of the fats more oxygen is set free from the original carbohydrate. In the formation of proteins, nitrogen, sulphur and other elements are added to the product already prepared by the plant. In each case more energy is required and this is supplied by the oxidation of part of the carbohydrate already produced in the plant.

In the production of carbohydrates and fats the solid products in the soil are not taken up. Even the carbon in the decaying vegetable matter in the soil is used by the plant only after it is given to the air as carbon dioxide. In the formation of protein, however, many other elements are needed, most of which, except nitrogen, are always derived from the solid matter of the soil. The most important of these elements quantitatively is nitrogen, which is present in abundance in the air, but is wholly unusable in such a form by the plant. Nitrogen as used by the plant must be in the form of a soluble combination with

other elements. Such forms of nitrogen are always in the soil to a certain extent, are applied sometimes in the form of chemical fertilizer, are frequently produced from atmospheric nitrogen by bacteria in the soil and on the roots of leguminous plants and are restored to the soil by decaying plant tissue or animal manure. The other chief elements needed by the plant are phosphorus and potassium, each in suitable forms of combination with other elements. All of these products are usually present in the soil to a certain extent, but, after continuous cropping, are not available in sufficient abundance and in the proper form to produce the highest yield of crops. The farmer must, accordingly, assist nature, not only in planting and harvesting, but also in supplying new fertilizer and in assisting in the process of rendering more of these necessary auxiliary products more readily available to the plants from the less available forms already in the soil.

COMPETITION BETWEEN MAN AND BEAST FOR VEGETABLE FOOD

Animals and men alike live on these plant products. To a certain extent men and animals are competitors for these products of solar energy. To a large extent they are not competitors under present-day conditions, much of the feed used by animals being useless and much more being undesirable for human consumption. Under the most intensive cropping systems the competition is keener. It is far from inconceivable that this competitive feature would become very serious if human population should expand to the point where man's pressure on the food resources of the earth was very pronounced.

When animals consume these plant products they convert part of the material into flesh and fat or milk and part into hides, wool and other by-products. Most of the feed, however, is used up as energy in the vital processes of the

animals. The carbohydrates, fats and some of the elements in the proteins turn into water and carbon dioxide, and the remainder of the proteins and the undigested material in the food are voided and are available for the soil in the form of manure. Only a small proportion by weight of the feed used by the animals appears as human food in the meat and fat of their carcasses when slaughtered.

Against this apparent great wastefulness must be placed the fact that the proteins of the meat are more valuable for human food than the average vegetable proteins of the feed and that the animals carry farther than do the plants the process of making fats out of the less valuable carbohydrates.[1] Much of the animal feed, moreover, is entirely or partially useless for direct human consumption. All animals can utilize plant products that are useless to man. This is particularly true of the cattle and sheep which can live on such roughage as hay and cornstalks. Meat-producing animals are, accordingly, concentrators of food, taking the less useful products and making a smaller amount of much more valuable food for man's use.

It is not uncommon in discussions of the food problem to overemphasize the competition for food between men and beasts. It cannot be denied that much grain and other food that is perfectly good for human consumption is fed to animals and many acres are devoted to raising feed for animals that might be used for growing wheat and other crops that man could eat himself. On the other hand, even in the case of wheat, only 70 per cent of even the grain goes into our bread and the remainder of the grain, which is known as "milling offals," and all the straw, is available for animal feed. It also has been found to be very uneconomical to use the same field for

[1] See page 43, *supra*.

wheat or many other crops continuously, and many of the other crops grown in other years in rotation are available for animals. Much of our land is also too rough to be put under cultivated crops and can best be devoted to the growing of feed for the animals. Some of these products could be turned back to the soil immediately to improve the fertility. However, it is more economical, once the solar energy has been turned into plant tissue, to give what part man cannot use himself to the animals and let them convert as much as possible of it into human food. The carbonaceous material is not plant food in any case and whether or not it is more useful in improving the character of the soil after it has gone through the animals than it would be if applied immediately to the land is an open question. Part of the nitrogen and phosphorus is lost when used by the animals, but this loss is offset by other gains. Meat-producing animals save for human food a great deal of plant product that would otherwise find little or no usefulness.

Viewed from the standpoint of energy units, or calories, alone, the production of animal foodstuffs is very expensive. A great many more calories are consumed than are produced in making meat. A comparison between the weight of feed consumed by the animals and the meat which they produce gives a still more striking contrast.

The United Kingdom, before the war, produced about 66 million tons of dry matter in crops. Including the grain used for making liquor only about two and three-quarter million tons, or less than one twenty-fifth of the total crop was consumed direct by the human beings. After deducting feed for the horses, about 54 million tons of domestic dry feed was eaten by the animals and poultry which produced meat, milk and eggs. With imported feeds the total consumed by the animals equaled about 62 million tons a year. The meat, milk and eggs

produced amounted to only about one and one-half million tons of human food.[2]

The situation is not quite so striking in some other countries, but in the following discussions of conditions in the United States and other countries it will appear that the animals get the produce from the largest share of the earth's productive surface.

RELATIVE ECONOMY OF DIFFERENT ANIMALS AS FOOD PRODUCERS

A British authority, Professor Wood of Cambridge, gives the following data on the relation between feeds consumed and food produced by various animals.[3]

RELATIVE ECONOMY OF DIFFERENT ANIMALS AS FOOD PRODUCERS

Animal	Human Food Produced	Pounds of Dry Food Consumed per Pound Dry Human Food Produced	Kind of Feed Consumed
Cow	Milk, veal and beef	12	Chiefly grass, roots and hay
Pig	Pork, bacon, ham, etc.	12	Chiefly meal made from grain
Fowl	Eggs and flesh	14	Chiefly grain
Sheep	Mutton (and wool)	24	Chiefly grass, roots and hay
Steer	Beef	64	Chiefly grass, roots and straw

[2] T. B. Wood, *Chemistry of Crop Production*, pp. 186-188.
[3] T. B. Wood, *The National Food Supply in Time of War*, p. 33.

American authorities, Professors Henry and Morrison, supply somewhat comparable data as follows:[4]

HUMAN FOOD PRODUCED BY FARM ANIMALS FROM 100 POUNDS OF DIGESTIBLE MATTER CONSUMED

Animal	Marketable Product, Pounds	Edible Solids, Pounds
Cow (milk)	139.0	18.0
Pig (dressed)	25.0	15.6
Cow (cheese)	14.8	9.4
Calf (dressed)	36.5	8.1
Cow (butter)	6.4	5.4
Poultry (eggs)	19.6	5.1
Poultry (dressed)	15.6	4.2
Lamb (dressed)	9.6	3.2
Steer (dressed)	8.3	2.8
Sheep (dressed)	7.0	2.6

In certain broad lines the data agree. Each authority lists the dairy cow as unsurpassed in efficiency and the steer as quite inefficient. In the one case the whole life cycle of the cow appears to be taken, including the veal of her calves and the meat of her carcass. In the other, apparently, the cow is taken simply as a finished milk-producing machine, ignoring her own growth, her calves and her carcass. Naturally, in the latter case a higher percentage of food produced for feed consumed is shown, but the findings are less fair. The greatest loss in food value in animal husbandry comes from the necessity of maintaining the bare vital functions of the animal. A certain minimum allowance is necessary merely to maintain life. What exceeds this may produce milk or increased weight of meat.

In the light of these two exhibits it is not easy to discuss the relative economy of different classes of animals as

[4] Henry and Morrison, *Feeds and Feeding*, p. 90.

food producers. Two matters are prominent in each: the relative economy of those animals which are capable of the most rapid finishing and the high cost in any case of animal food products in terms of the weight of feed consumed. Man does not receive back more food, but less, quantitatively, through animal husbandry. One other matter deserves attention before any comparisons are made: many other valuable, if not indispensable, products are produced besides human food in addition to the plant food returned to the soil.

The cow as a milk producer, as shown in the second exhibit, gives none of these secondary by-products other than fertilizer; neither does the hen. We might derive more skin from the pig; but, relatively, the pigskin and bristles are not very important by-products of the regular pork industry, and the pig can almost be classified along with the hen and the milking cow as producing nothing of value but food. These facts must be appreciated before comparisons of efficiency are made between animals.

These animals which do not contribute important by-products are much more efficient producers of food than are the other classes. How far the wool of the sheep or lamb offsets loss of food is, of course, impossible to estimate without qualifications. Under frontier conditions with lack of ready transportation facilities the fleece is more valuable than the carcass. In producing regions near the market the opposite is the case. Changing market conditions change the relative value of the carcass and fleece. There can be little question, however, but that under general conditions the value of the fleece offsets the lack of meat-producing economy to a considerable degree. Taking the average values of wool and mutton and lamb as imported into Great Britain the year before the war and using the figures for meat and wool production given by the British authority quoted above, we find that the meat

of a twelve months' old sheep was worth $2.49 and its wool $2.20. Since Great Britain is the greatest market for both wool and mutton or lamb, values in that country are the truest values for world-wide comparisons. In the light of such figures, the sheep or lamb cannot be considered as a much poorer converting machine than the cow, pig and hen if efficiencies equal to the British example can be attained. Another factor is to the credit of the sheep; it consumes comparatively little grain which might be eaten by man himself, while other animals, particularly the pig and hen, consume these concentrates very freely. The sheep is largely fed either on grasses grown where there is no competition with man's food or else on roots. The feed which it converts into high-class food and clothing material is chiefly of low grade.

To a certain extent the value of the hide and other by-products of the steer offsets his apparent lack of economy as a food producer. Here again it is difficult to estimate the relative value of the hide. There is no question as to the fact of its auxiliary value, but there is great difficulty in estimating a true normal relative value for these by-products. In the summer of 1919 the hide made a large showing in the total value of the steer carcass. In normal times, however, this value is of much less comparative importance.

The divergence of findings by these eminent authorities makes it difficult to arrive at a definite conclusion as to the efficiency of beef production. Aside from the possibility of difference in the definition of the "dry human food" of one and the "edible solids" of the other there is a possibility that the steer of the American exhibit is a younger and less highly "ripened" animal than the British steer. The economy of the steer in the American exhibit is very comparable to figures given elsewhere by the same British author for a much younger steer and by

other British authorities for a typical steer and is not at all impossible to attain in the production of beef.

The strikingly poor showing of the steer in Professor Wood's data, doubtless, does not exaggerate conditions as they exist in a great deal of our beef production. However, these figures taken alone give an unduly dark picture for this industry. When forage is not present in such abundance that it is used carelessly and when steers are raised in accordance with the dictates of science and the conservation of feed a much better showing is made. Gilbert and Lawes found many years ago that oxen required 13.0 pounds of dry substance in feed to produce one pound of increase in live weight, while sheep required 9.2 pounds and pigs required 4.8 pounds. These findings are much less discouraging. Sir Daniel Hall, in commenting on Gilbert and Lawes's findings, notes the improvements in animal husbandry since the time when these experiments were made. He says: "The modern farm animal is in fact a more efficient meat-producing machine than it was fifty years ago, capable of dealing with more food and of growing more rapidly to maturity, thus shortening the time during which food has to be consumed for purposes of pure maintenance only. It is in this direction that new experiments and additional data are generally needed, for we know nothing of the relative capacities of modern herds of farm animals as meat producers, or of their digestive powers for various foods."[5]

The reason for the different efficiencies of various animals as meat producers is more evident when it is seen that the capacity of an animal to convert feed into food decreases rapidly with age. The pig, being slaughtered young, gains its great advantage in this way. On the other hand, a steer raised slowly on roughage until he is three

[5] A. D. Hall, *The Book of Rothamsted Experiments* (2d ed., revised by E. J. Russel, 1917), pp. 248, 249.

years old before being put into the fattening pen loses in efficiency on account of the long time during which he is using feed to maintain life. Steers slaughtered at eighteen months of age consume very much less feed per unit of meat produced than three-year-old steers do, and calves produced for veal according to the practice on the Continent use still less feed per unit of product. Younger animals also yield a relatively higher proportion of the choicest parts of the carcass.[6]

A well-bred steer raised efficiently makes a comparatively good showing as a food producer. An Irish authority compares the efficiency of two-and-a-half-year-old steers in the feed lot with cows of different milk-yielding capacity. The following results show that a good steer is a better food producer for his last four months on the feed lot than even an 800-gallon cow:[7]

FOOD-PRODUCING ABILITY OF COWS AND STEERS

	400-Gallon Cow	600-Gallon Cow	800-Gallon Cow	1,000-Gallon Cow	Steers
Feed units consumed	4,758	5,231	5,854	6,536	5,950
Starch equivalents produced	667.3	1,001.1	1,334.8	1,668.5	1,421
Food units required to produce one starch equivalent	7.13	5.23	4.39	3.92	4.19

These results are for the finishing period of four months for the steers. All available evidence would lead to the

[6] T. B. Wood, *The National Food Supply in Time of War*, p. 34; M. Laplaud and E. Degoys, "De la sélection des bovins et de la proportion des trois catégories de viande dans la viande nette," *La Revue de zootechnie, revue des éleveurs*, Year 3, No. 7, pp. 11-12.

[7] James Wilson, "The Most Highly Productive Crops and Stocks," *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XVIII, pp. 285-295.

conclusion that young steers kept constantly in good growing condition put on more flesh per unit of feed earlier in their careers than during their latter days. The steer has the advantage over the heifer for the two-years-and-a-half period of growth, for the flesh laid on in that period by the steer makes good meat, while that of the heifer deteriorates during her milking period to a light weight and poor quality.

In comparing the efficiencies of cows and steers it must be remembered that the cow maintains her producing period for a longer period than the steer. However, that is to the disadvantage of the steer only to the extent to which the breeding herd is maintained for producing calves for raising beef. The calf from which the dairy cow comes is practically nothing but a by-product of a milking herd and as such has but little cost. The beef calf must bear the cost of his own start in life. Otherwise it would seem that the good beef steer described above had no handicap compared with the cow producing 800 gallons of milk.

These comparisons are based upon steer raising at its best, while the comparisons given earlier are based upon ordinary practice in animal husbandry. Eventually more meat production will be brought to this more efficient basis.

The beef animal, as it is usually slaughtered, makes very great demands upon the stocks of feed. As a converter of feed into food it probably is the least efficient of the ordinary meat animals. This is because of the long time usually taken to bring it to slaughtering condition. In no case is it so rapid a developing animal as the pig or lamb, and as ordinarily produced it is particularly slow. The pig and lamb are slaughtered so young that there is relatively little waste in maintaining the vital functions. The three-year-old steer has used up more than half of the feed for

its lifetime in simply maintaining life.[8] No wonder the production of beef, under ordinary conditions, makes a heavy drain on feed resources. There is no need, however, of using such methods eventually in the production of beef, excepting on the frontier of civilization or on the roughest kind of grazing lands. Hitherto its production has been based in large measure upon the abundance of feed. Under such lavish feed conditions we can expect but a poor showing of efficiency. Enough strides have been made already in the intensive production of beef to show that such wasteful methods are unnecessary. Offsetting such inefficiency as exists is the fact that the feed used to produce beef is always in appreciable measure fodder which cannot be consumed by man and frequently fodder which in no way competes with the production of man's vegetable food, while the pig's feed is largely grain which is highly suited to man's own use. The carcass of the steer is also largely high-grade protein, while that of the pig is mostly fat.

RELATIVE EFFICIENCY OF YOUNGER ANIMALS

The relative inefficiency of the more mature steer as a meat producer gives a striking argument for the necessity, where unlimited rough fodder is not available, of adopting such types of animal husbandry as make the animal ready for slaughter at the earliest possible age. Evidence given by various authorities also shows unmistakably that a shorter period is more productive than a long one in terms of food units produced for a given quantity of feed in fattening animals.[9]

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[8] Wood, *loc. cit.*

[9] Wood, *The National Food Supply in Time of War*, p. 36; Peters and Carnes, "Cattle Feeding Investigations," University of Minnesota, Agricultural Experiment Station, Bulletin 200 (1922); Henry and Morrison, *op. cit.*, p. 437.

In the carcass of either a very young or thin animal there is a higher percentage of water than in one in good slaughtering condition, and the elimination of this somewhat obscures the evidence of fattening efficiency. Weight of dressed carcass alone in terms of feed consumed is an insufficient criterion; however, for the first three months of fattening, 8 to 13 pounds of concentrated feed are used for one pound of dry human food in the carcass, while in the second three months this figure rises rapidly to 35 pounds, according to a leading authority.[10]

It cannot be argued too rashly that the slaughter of animals should be accomplished at the stage in growth and fattening when the greater number of pounds of dry food per unit of feed consumed have been produced. Quality as well as quantity of product must be considered. The fattening of animals, particularly beeves, greatly improves the quality of the lean meat as well as increasing the accumulated fatty tissue which is largely wasted in consumption. Fattening produces an increase of fat within the fiber of the muscle as well as the "marbling" or deposit of fat between the bundles of fibers. The high-class beef animal lays on fat in this manner rather than in bunches around the visceral organs or in layers under the skin. This deposit of fat in the meat itself increases its tenderness, juiciness, flavor and nutritive value. It is suggested that such "ripening" also increases the soluble protein and availability for human nutrition.[11] It, of course, is possible to carry the fattening process too far, but, as fattening is ordinarily accomplished, the addition of the available fat itself is one of the prime reasons for "ripening" beef. Fat is one of the chief justifications of animal products for human consumption, containing as it

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[10] Wood, *The National Food Supply in Time of War*, p. 36.
[11] Henry and Morrison, *op. cit.*, 18th ed., p. 84.

does the fat-soluble vitamin and being necessary of itself for proper nourishment.[12]

PASTURE VERSUS CULTIVATED CROPS FOR FEED

The production of meat on pasture ordinarily shows a small return in food output per acre. Sir Thomas Middleton has shown[13] that arable farming produces more than twice as much human food per acre as even the best pasture devoted to beef production. His findings show that a good arable farm on which cattle are fattened will yield as much meat per acre as the same land would under grass with the grain raised as a net addition to the amount of food produced for human consumption. If the grain is fed to the animals, the arable farm will produce twice as much meat as the same land under grass.[14] Middleton also points out that there is a very great variation in the productivity of grassland. Land under wheat seldom shows a greater variation than from one to three, but meat production on grass shows ten to fifteen times greater output in weight on good pasture than on poor, and the nourishing value of thin watery meat produced on the poor land may be only one-fortieth of that of the meat produced on an equal area of good pasture.[15] Obviously much pasture land is very inefficient in food production. The poorest land may not be worth cultivating, but research shows that, when sufficient moisture is present, its yield as pasture may be increased very greatly by proper auxiliary fertilization with phosphates and lime.[16]

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[12] E. H. Starling, *The Feeding of Nations*, pp. 71-74.

[13] T. H. Middleton, "Systems of Farming and the Production of Food," *Journal of the Board of Agriculture* (Eng.), 1915, pp. 520-533.

[14] A. D. Hall, *Agriculture after the War*, pp. 32, 33.

[15] Middleton, *Food Production in War*, p. 77.

[16] William Somerville, Presidential Address before the British Association, reported in *Experiment Station Record* (U. S.), Vol. XLII, pp. 106-108.

Some land is not sufficiently favored by nature to make it worth cultivating in the present stage of the world's development. Much of this land will probably always be used for grazing.

Land which is fit for cultivation can be used for raising crops primarily for man's direct use, for animal feeds or for the two combined. The fact that almost no crop does its best when raised continuously on the same land year after year makes it profitable to grow different crops in rotation and most of the best rotations contain crops which are practically useless for man's direct use, but which are very valuable for animal feed. Many of the crops most productive of direct human food also contain a large residue of great value for feed. Sugar beets are an outstanding example of this. Even the bread grains also contribute all the straw and about one-quarter of the grain as it is milled for use in occidental countries. Many of the crops raised primarily for animal feed, moreover, yield so much net thermal energy per acre that the net production of human food through the meat is not relatively low. Mangels yield twice as much stored-up solar energy per acre as does wheat even with its straw.[17] Indian corn, with its stover, also produces a large yield of energy per acre and even the grain is comparatively poor for human food, but excellent for animal feed.

ANIMAL HUSBANDRY AND SOIL FERTILITY

It is frequently contended that a system of farming which combines animal husbandry and the raising of crops may improve the fertility of the soil without the addition of plant food from outside sources. Certainly commercial fertilizer and imported feeds were a negligible item even in England until the middle of the last century, and

[17] Wilson, *loc. cit.*

yet there can be little or no question but that the farms of England had been improving rather than degenerating in fertility during this period when that country was fed on the product of its own farms. A comparison between the Elizabethan and the Victorian eras would show a great increase in the productivity of the soil. There seems to be some truth in Prothero's statement[18] on the progress of farming in England (1700-1760) that, "roots, fed on the ground by sheep, fertilized and consolidated the poorest soil. Another portion of the crop, drawn off and stored for winter keep, helped the farmer to keep more stock, to obtain more manure, to enrich the land, to increase its yield to verify the truth of the proverb, 'A full bullock-yard and a full fold make a full granary.' Farming in a circle, unlike arguing, proved a productive process."

Professor Simkhovitch has made careful historical studies of the decline of agriculture in ancient Rome and in medieval Europe and has found that without the hay and leguminous fodder the productivity of the land declined seriously, but that the introduction of these animal fodders at the beginning of modern times brought about an era of increasing soil productivity. He states: "The introduction of grass seed and clovers marked the end of the dark ages of agriculture. It is the greatest of revolutions, the revolution against the supreme law, the law of the land, the law of diminishing returns and of soil exhaustion.[19]

The truth is, doubtless, that the increase in productivity brought about by the chemical changes in the soil, by marling and by the growth of nitrogen-fixing plants, was greater with the aid of animal husbandry than it would have been without it. It is certain that those parts of

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[18] R. E. Prothero, *English Farming Past and Present*, p. 174.

[19] V. Simkhovitch, "Hay and History," *Toward the Understanding of Jesus and Other Historical Studies*, p. 161.

western Europe which were forward in animal husbandry were improving rather than losing the productivity of their farms before the era of introduction of plant food from outside sources in the form of commercial fertilizers and animal feeding stuffs. What may be accomplished in the future by artificial means of making straw and other roughage more immediately useful for improving the soil is still an open question. The economy of maintaining the productivity of the soil in the future through the development of animal husbandry is, of course, not proved even though it be conceded that the soil has been so improved in the past and that animal husbandry was a necessary accompaniment of such improvement. The future will bring new technique in agriculture and it is impossible to say what may be the relative economies of different techniques in future years.

The United States Department of Agriculture states the case for animal husbandry in relation to fertility of the soil as things stand to-day in the following words:

> The superiority of a general system of farming based on forage crops and live stock over specialized systems, such as wheat farming, cotton farming, or fruit farming, is being increasingly recognized. No artificial fertilizer can fully replace animal manures in maintaining crop yields. Moreover, many of the forage crops are legumes which in decaying add nitrogen to the soil. The grasses, too, as their roots decay, supply nutriment for bacteria that gather nitrogen from the air and add it to the soil. Their extensive root systems, the fine threads of which ramify throughout the soil, leave humus upon their decay and tend to keep the soil in excellent tilth. In brief, forage crops and live stock, under present conditions, constitute the best basis of a permanent agriculture.[20]

Experiments lasting about three-quarters of a century at the Rothamsted Experiment Station in England and for

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[20] *Agriculture Yearbook* (U. S.), 1923, p. 317.

a shorter period in some of the experiment stations in the United States, notably Ohio, prove that soil productivity can be maintained without the application of animal manures. Apparently, plants get a quicker start on commercial fertilizer than on manure and this early start increases the yield of the crop immediately following the application. Chemical fertilizers are also particularly valuable in building up the productivity of soils which are naturally lacking in some of the elements of plant food. For such a purpose they may with advantage be added to land devoted solely to the growth of feed for live stock.

When part of the feed of the stock consists of concentrates brought in from other sections, the manure certainly adds to the stock of plant food in the soil. This is the case to a large extent in western Europe. On the other hand when the feed comes from the land to which the manure is returned, the animals add no plant food, but they may assist other natural forces to add to the store of plant food, and the resulting humus and improved quality of the soil also may improve that general character of the soil which is known as fertility.

Chemical fertilizers and animal manure should not be thought of as competing agencies in upbuilding the soil. The former is a supplement of the latter and as such will probably be used more extensively in the future in spite of its high cost.

The long-term experiments of the Rothamsted Station founded by Sir John Lawes, one of the originators of the chemical fertilizer industry, show the value of barnyard manure compared with chemical fertilizers for maintaining crop yields in the long run. Numerous experiments at that station and others and practical working demonstrations on farms prove that excellent crops can be produced with chemical fertilizers without manure, espe-

cially if green crops are plowed in. They also show that in many cases the addition of chemicals to the manure is a real advantage. However, in the long term of years covered by the observations at Rothamsted, manure has proved its value. In the production of barley, mangels, turnips, potatoes and sugar beets manure has proved its greater crop-producing value than other fertilizers. Sir Daniel Hall, in reviewing the experiments, lays particular emphasis on the value of manure as compared with chemicals in the case of a number of crops.[21] The results with wheat up to 1911 showed less striking improvements with manure as compared with chemicals.[22] Professor Wood, writing at a later date after the experiments had been maintained for 70 years, states that "the best yield is given by farmyard manure."[23]

There also is no question but that the yield of most crops is greatly improved by rotation with other crops. Wheat grown continuously at Rothamsted yielded an average of only 11.8 bushels an acre and in rotation with other crops averaged 26.9 bushels without fertilizer of any kind.[24] One great advantage of animal husbandry in farming is that it makes a profitable use of the crops which can be grown most beneficially in rotation with bread grains. In a mature animal which is not putting on flesh or producing milk the disposition of the feed is entirely different from that of a growing animal. The case of the fattening animal is again different. The working horse retains practically no nitrogen from its feed and even almost all the ash is voided in the manure. A rapidly growing animal, such as a calf, retains a large part of the elements of its feed, using them to produce meat, it being

[21] Hall, *The Book of Rothamsted Experiments* (1917), pp. 72, 98, 119, 121, 122, 126, 128, 132.
[22] *Ibid.*, pp. 31-68.
[23] Wood, *Chemistry of Crop Production*, p. 172.
[24] Hall, *loc. cit.*

a fairly efficient food-manufacturing machine. It voids only about 30 per cent of the nitrogen and 45 per cent of the ash of its feed. A fattening animal which is nearly mature retains but little of the fertilizing elements supplied in its feed. The elements which it retains are largely those which the plant can get from water and the atmosphere in the form of hydrogen and carbon. The fattening steer and sheep retain about 5 per cent of nitrogen and ash, while the pig, which is both growing and fattening, retains about 15 per cent of the nitrogen.[25] The organic matter restored to the soil through the manure is also very important for the maintenance of fertility. There is loss here again in quantity, but the quality of the organic matter in the manure is peculiarly valuable for the soil.

Were the fertilizing elements of the manure not subject to wastage it would seem that what nitrogen, phosphorus and potash was not turned into human food would be returned to the soil as plant food. Unfortunately, the nitrogen of animal manure is subject to great wastage in the form of volatile ammonia gas and to more or less wastage through leaching away with the drainage water from the land. As manure is frequently handled this loss is very heavy. Heavy losses, however, are avoidable and will, doubtless, be eliminated as the growing density of population renders conservation more necessary in every line. There seems no reason to believe that all such wastage can ever be eliminated. But it is estimated that it can be reduced to 20 or even to 10 per cent.[26]

Taking into consideration the wastage as it exists, the English have carefully worked out the normal or average fertilizer return for feed consumed upon the results of long observation at the Rothamsted Experiment Station. Based upon these results the Central Association of Agri-

[25] Henry and Morrison, *op. cit.*, p. 273.
[26] *Ibid.*, p. 280.

cultural and Tenant Right Valuers has adopted a careful system of credits to be allowed to an outgoing tenant for feed given to animals whose manure has been applied to the land and not removed by a succeeding crop. A credit of three-fourths of the total value of the phosphoric acid and potash in the feed is allowed for all types of animal husbandry. Owing to the heavy loss of nitrogen through the fermentation in stored manure, the tenant is credited with only 50 per cent of the total value of the nitrogen for such stored manure, but 70 per cent when the stock has been fed at pasture.[27]

If we could fully accept the teachings of the old school of thought which regards the plant food in the upper layer of the soil as the equivalent of a bank account we must conclude that there can be no question but that the farm which markets its output in the form of live-stock products loses much less plant food than does the farm which sells all its crops in unconcentrated form. This is abundantly manifest from what has already been shown as to the small weight of foods produced by live stock compared with the weight of feed which they eat. The agriculture of such new countries as the west of North America has often been classified as mining. Every marketable part of the crop is sold off the place, taking with it all its plant food in the case of a grain farm. In the case of a farm which turns its crops into live stock, the plant food cropped out of the soil is by no means all shipped away, but is largely retained upon the farm. In either case some plant food is sold and the teaching of the old school is that it must be restored. In case of the grain farm all the plant food entering the crop is sold at a relatively low price. In the case of the mixed farm the food values are selected, returning the larger part to the soil and making ready for sale the

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[27] *Ibid.*, p. 277.

smaller portion valued at a sufficiently higher unit price to render the total value of the product sold greater in most cases than the total commercial value of the crop consumed. In this latter case we may have as great a money income with a small plant food loss as for the grain farm with a high loss for the soil. Whether one or the other system is immediately profitable would depend upon the relative market prices ruling for crops and animal products. The ultimate profit for the owner of the farm would depend upon the relative exhaustibility of his soil and the cost of restoring its fertility. Since the supposition that plant food must be maintained as a bank account is subject to serious limitations, this argument cannot be applied with any mathematical rigidity.

ECONOMY OF TURNING VEGETABLE PRODUCTS INTO MEAT

The question naturally arises as to whether or not, in the light of available evidence, the food value of the meat produced is sufficiently greater than the feed consumed, after allowing for the effect upon the fertility of the soil, to warrant such a conversion. Money values again always rule at any particular time or place, but money values must ultimately follow the gain or loss of the more fundamental factors involved. Apparently the nitrogen used is the most essential element, the others being more largely returned to the soil or restored by capillary action from lower levels in the earth. If we take the lowest figure given above—50 per cent—for the return to the soil of the nitrogen and the percentage retained by the fattening ox for flesh, which is about 4 per cent, we should have a heavy loss of nitrogen. Even using the intimation of the War Food Committee of the British Royal Society, and other authorities, that the availability of animal protein is two or three times as great as vegetable proteins for the re-

construction of the human tissues, we might still have a waste of more than a third of the available nitrogen. This is the most unfavorable deduction possible, using wasteful methods. If we take the dictum that under proper management not more than 10 to 20 per cent of the nitrogen will be wasted from the manure, we find the possibility of gaining available nitrogen by feeding to an ox even protein fit for direct human consumption. In the case of the fattening pig the retention of protein by the animal tissues amounts to nearly 15 per cent, and would readily show a real economy in providing suitable protein for the human tissues. In the case of the calf, which retains 59 per cent of its proteins, the economy of having the proteins selected, and perhaps reformed, would be obvious were it not for the fact that calves are normally fed largely on milk, the protein of which is approximately as valuable as any for human nutrition.

The other chief element supplied to man's food by meat is fat. This neither adds to nor takes from the plant food in the soil. Whatever is lost in converting it from the fats and carbohydrates of the vegetable world returns to the atmosphere, whence these same elements are readily recoverable by the plant world. However, it is poor economy to recover them once and throw the largest percentage away to be recovered anew by an expensive process unless the quality of the small proportion left in the animal fat is sufficiently greater than oils and starches in the feed to warrant the conversion on such terms. It is difficult to equate the values of animal fat and its sources. Animal fats are mostly made from vegetable feeds which are not fit for human food. Grain, however, is used for feed which might be used for human food. Ordinary vegetable foods, however, as already noted, do not contain as high a proportion of fats or oils as is desirable for man's best nourishment. It must be remembered also that the so-called fat-

soluble vitamins are apparently present in the animal fats in very much higher degree than they are in vegetable oils as we use them, while they are apparently lacking in the starches. There seems, accordingly, to be a very excellent case for the conversion of even feed available for man's use into animal fats, if no other feed were available in sufficient quantity. This does not mean that an indefinite amount of such conversion should be made, nor is there sufficient dietetic knowledge available to determine the amount of such conversion advisable. It merely indicates that man's highest needs demand some animal fat, even, if necessary, at the expense of grain concentrates fit for human consumption.

UNQUESTIONABLE ECONOMY OF ANIMAL HUSBANDRY BASED UPON FEED NOT USABLE BY MAN

All this is largely on the supposition that the animal feeds are either fit for human consumption or else supplant human vegetable foods in their growth. Of course this supposition does not apply to present-day conditions. There is no question but that vast quantities of feed are available and can be made available that do not compete with the production of human food. Not only do we have the range, much of which may never be converted into arable land, but hillsides which are uneconomic for other food production than pasture, and by-products of human food production such as corn stover and the wheat offals left when making flour for bread, all of which will continue to be available for the feeding of animals. Even in those parts of China where no square foot of tillable land is spared unnecessarily from human-food production, except for graves, and where human tastes are not as exacting as in some countries, there is enough material available for the feed of pigs and chickens and even cattle to provide for a large number of stock.

It is readily apparent that the production of meat is profitable in regions where there is an abundance of cheap feedstuffs. Nothing can be said against converting into human food material not available for man's direct nutrition. The question is whether or not with increased demand for food, crops suitable for man's immediate needs will crowd out those used for animal husbandry.

Much light is shed on this question by the statistics showing the numbers of live stock in various countries in proportion to the acreage tilled. It is a fact, that, by and large, after we leave the open range where true agriculture does not exist, we find the proportion of live stock on farms increasing as agriculture is more intensified. Animal husbandy has also tended to increase in those nations where agriculture has been intensified most rapidly in the last half century. This phase of the question will be discussed more fully in the next chapter.

CHAPTER III

THE DISTRIBUTION AND DEVELOPMENT OF MEAT PRODUCTION

Meat production is distributed very unevenly throughout the world. Some sections of the earth produce large amounts of meat in proportion to their area while in some other sections meat production is negligible. Many influences contribute to the variation in the importance of this industry both when viewed geographically at the present time and when viewed historically with the development of the leading civilized countries. The climate and other natural factors, the supply of feeds, the ravages of disease, the availability of markets for the product and the meat-producing capacity of the breeds of live stock at hand at any time and place are all contributing influences to the development of this industry. The stage of the economic development of the region, however, is one of the greatest forces in affecting its importance. While animal husbandry is predominant in newer or frontier countries, it does not, as is frequently supposed, diminish in importance as the frontier is left behind. It reaches its greatest development in the countries which have the denser human populations. Outside of the actual urban communities increased density of human population is ordinarily accompanied by an increased importance of animal husbandry.

ANIMAL HUSBANDRY MORE IMPORTANT IN MORE DENSELY POPULATED COUNTRIES

Too much emphasis has been placed by some writers upon the obvious fact that there are less meat-producing

animals per human being in the more densely populated countries.[1] It is but natural that when the national population is so greatly swelled by the growth of cities whose people take no part in the primary production of any food the increase in the numbers of animals should lag behind that of the human beings. Modern transportation, which allows important sections of the world to depend heavily upon other sections for their food, leaves no reason for any type of food production to keep pace with demand in such countries. The significant questions are as to whether or not meat production keeps pace with that of other food production in such circumstances and whether or not meat production actually increases in the communities where the population becomes more dense. A careful examination of the evidence shows a general tendency for animal husbandry to become more important per unit of area as population increases until city boundaries are reached. Also in the countries where occidental civilization prevails there is a strong tendency toward an increase in animal husbandry in comparison with the raising of crops for direct human consumption after the actual frontier is left behind and the more densely peopled sections are approached. Climatic and other factors, of course, introduce disturbing influences which keep these general rules from being universally applicable.

The available statistics on the numbers of live stock per acre of farm land in the chief countries of the world are illuminating. The accompanying charts show clearly that increasing density of human population almost up to the point of urbanization ordinarily carries with it an increase in the numbers of live stock. Of course, the more intensive

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[1] Ellsworth Huntington, "The Distribution of Domestic Animals," *Economic Geography*, July, 1925, pp. 143-172; J. R. Smith, *The World's Food Resources*, pp. 173-187.

development of animal industry is usually based in part upon feed shipped in from other regions.

Charts illustrating the situation in Europe are presented because less disturbing factors enter the situation in that part of the earth's surface. It contains no deserts, is practically all in the temperate zone and has all been settled for so long that natural forces have had time to make themselves fairly strongly felt.

CHART 1.—CATTLE DISPERSION IN EUROPE.

(From *Geography of the World's Agriculture*, p. 123.)

An examination of census data for the United States shows that there is a strong tendency already for the same relation to manifest itself between the density of human beings and animals in this country. The numbers of both cattle and hogs per square mile increase definitely as the more sparsely settled regions are left behind and decrease again only in those states which strongly tend toward urbanization.

As a world-wide proposition the same general relation

exists between the numbers of animals and the human population. Comparisons between the continents would not show the tendency at all clearly for so many other disturbing factors enter the situation. Taking the world continent by continent, however, the working out of this tendency is very significant for animals in general, taking in the various types of animals that exist in each section. Ellsworth Huntington's presentation of this tendency is

CHART 3.—SWINE DISPERSION IN EUROPE.

(From *Geography of the World's Agriculture,* p. 133.)

very striking and shows that this rule holds true even in Asia.[2]

These data show that increased attention to meat production goes well with both greater density of population and more intensive agriculture. It appears that animal husbandry is far from being driven out under such circumstances and left to new and sparsely inhabited lands.

Belgium before the war was one of the most densely

[2] Huntington, *loc. cit.*

populated countries in the world, and yet Belgium had 701 head of cattle and 476 head of pigs per unit of productive area, while the United States had only 170 and 184 head

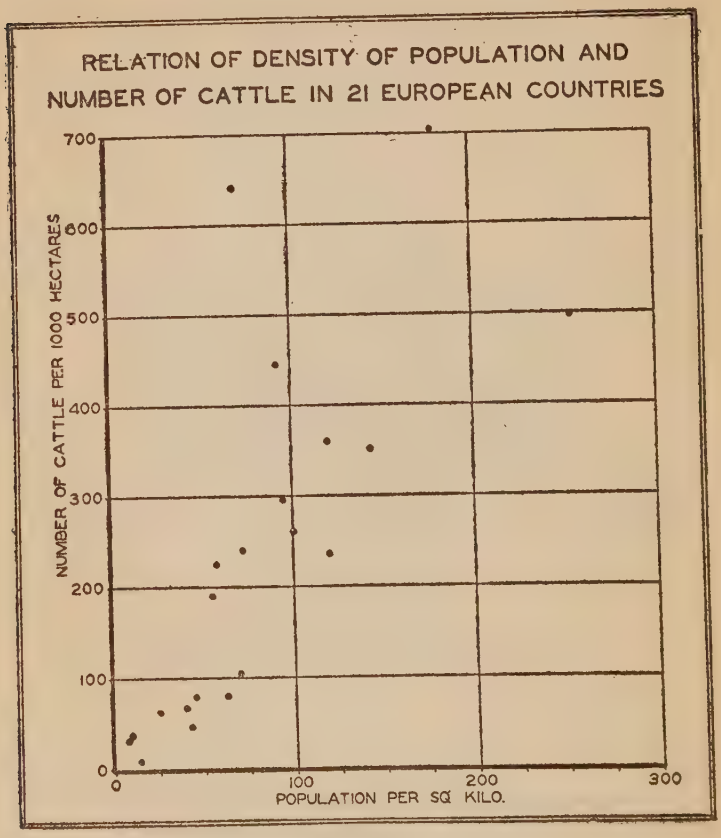

CHART 4.

respectively. This is no chance circumstance, for in the same unit of area the Netherlands had 690 head of cattle and 429 head of pigs, Denmark 605 head of cattle and 394 head of pigs, Great Britain and Ireland, 449 head of cattle

and 1,153 head of sheep, Germany 395 head of cattle and 429 of pigs and France 288 of cattle.[3] To what extent the animal industry in these countries is dependent upon food supplies from the outside world will be discussed later.

Many of these cattle, of course, are dairy cattle. The proportion of milch cows to other cattle does not show a great preponderance of the dairy industry over the beef industry in the intensive agriculture of western Europe. In spite of the great importance of the dairy industry, the number of "other cattle" and of other meat animals is much greater in proportion to the agricultural area than in the United States. The dairy industry is also much more productive of meat in Europe than it is in America.

The relation between the density of human population and the number of animals is not the same for all classes of animals. For animals in general and for cattle in particular the relationship is quite clear. For hogs the same relationship tends to appear somewhat heightened by the fact that hogs are seldom associated with extensive grazing. In the case of sheep and goats no such relation is clear.

Sheep and goats are not usually the animals in popular favor under intensive conditions of meat production. These animals thrive better than others in semi-arid regions where the feed is relatively poor and uncertain. Where conditions are more ideal other animals are usually kept. An exception to this general rule appears in the sheep industry of Great Britain where these animals are kept in considerable numbers even under relatively intensive conditions. The goat outdoes the sheep in adaptability to stern conditions, especially in warm climates, and its geographical dispersion is affected accordingly. It apparently is true, however, in the case of both of these animals that,

[3] *Annuaire international de statistique agricole* (1909-21), pp. 237-248.

when natural conditions do favor their presence, they are kept in greater numbers in countries where the human population is more dense.

ANIMAL HUSBANDRY IN VARIOUS STAGES OF ECONOMIC DEVELOPMENT

Viewed historically, the relationship between human economic development and the live-stock industry follows approximately the same rules as those which appear in the geographical dispersion of to-day.

In the earliest stages of development there frequently is a high rate of live-stock production compared with other forms of agricultural activity. There are two general reasons for this: with a scattered human population it is impossible to develop intensive cropping, but the flocks and herds can themselves harvest the natural forage. In new countries which lack good transportation facilities animal products of high value per unit of weight can be shipped to the outside world more readily than grain, and the animals themselves have been frequently driven out on foot.

Passing beyond the earliest stages of development, the animal industries may for a short time be overshadowed by extensive grain growing, but this secondary stage soon passes and the live stock becomes relatively important again. It is noteworthy that in the countries of Europe, as economic development has progressed the live-stock industries have increased in relation to crop production. This is true in Germany as agriculture has become more intensified just as it is in England where the cultivation of the soil has decreased. In the following discussion of the various countries it will appear that this tendency has existed in many countries.

It is not only in numbers of animals that the increase in meat production appears. In the following descriptions

of various countries, notably of France, it will appear that increase in production has come from increased productivity per animal rather than from an increase in the numbers of the animals. It is just as true that the animals in the more advanced countries of densely settled western Europe produce more meat per thousand animals in the herds than do the animals in such frontier countries as Brazil and South Africa. There, of course, is no perfect correlation between increased density of animals and increased productivity per animal, but in general both productivity and numbers tend to increase as the countries become more highly developed economically and as the human population increases in density under the conditions of western civilization.

No thoroughly conclusive answer can be given to the question as to why the live-stock industry tends to a comparatively high degree of development in more densely populated countries. Such a development is usually based partially at least on imported feeds. And it is frequently suggested that it might be cheaper to ship the meat than the more bulky feed from the newer countries. However, under the conditions of relatively free international trade each part of the earth tends to turn its activities to what it finds most profitable, and extensive grain farming is among the least profitable things that can be done when there is an abounding population. Density of population tends to develop the industries which require relatively more human labor per unit of output. In this animal husbandry resembles manufacturing. As practiced under intensive conditions it gives employment to more people than most types of pure agriculture. Like manufacturing also it depends partially upon outside regions for its raw material. Hence it tends to be an elaborating rather than an extractive industry and all such industries tend to be developed where there is an abundance of population.

INFLUENCES OF SOCIAL FACTORS

Various social conditions vary these general tendencies. In the Orient religion plays a very important part in the development of the animal industries. The pig is a very unimportant animal throughout the Mohammedan world. Cattle, though abundant, are used but little for meat production among the Hindoos. The Chinese, as a rule, have a religious prejudice against beef and the Japanese have a social prejudice against pork. Horse meat, though used freely on the continent of Europe, is practically not consumed in the English-speaking world and, hence, horses are hardly to be classed as meat producers in such countries.

THE INFLUENCE OF MARKETS ON PRODUCTION

Availability of markets is an important factor in influencing the development of meat production. The nearness of good markets is an unquestionably strong factor in stimulating the production of meat in densely populated countries. On the other hand, Australia finds the fact that her beef can be put on the world's markets only in a frozen condition, a great handicap in developing her cattle industry. Throughout these last few years the slowness of demand in the world's markets has discouraged meat production in many lands.

THE AVAILABILITY OF FEEDS

The availability of feeds is, of course, a most important factor in the development of live stock.

Under the conditions of modern commerce the presence of an abundance of locally produced feed is not so vital in the more densely populated regions as it is in the newer countries. In new countries natural herbage is essential

for raising cattle and sheep. In western Europe much of the good pasture that does exist is due to man's skill in developing it artificially and much of the grain is imported. The Danish fields were not highly productive a century ago and the Netherlands are largely artificial lands which now, thanks to man's engineering developments, are most excellent pasture. Ireland stands out among the western European countries as a land in which the cattle industry is most important although the density of population is not very great. Probably the greatest reason for this is that the Irish pastures are naturally excellent, being kept green and productive most of the year by the oceanic climate.

In the less highly developed regions of the earth natural supplies of feed vitally affect the distribution of all animals industries. The Argentine is the world's leading source of beef largely on account of her extraordinarily good pastures. On the other hand, Australia and South Africa suffer in large part from a lack of good supplies of feed and the former country suffers from the handicap of an uncertainty of production even in the better sections. Then again much of the land in northern Africa and a belt stretching thence through Central Asia almost to the Pacific is so dry and short of feed that intensive animal husbandry is impossible and in parts nothing can be produced. In the Arctic regions also feed supplies are too sparse for any intensive animal husbandry.

THE INFLUENCE OF CLIMATE, TOPOGRAPHY AND SOIL

The availability of natural feed is inseparably tied up with the questions of climate and surface conditions. Temperature and water supply unfailingly affect natural herbage and the growing of artificial feeds. So also the degree of ruggedness of the country affects the use to which it may be put. Some mountainous regions are too

rugged even for goats. Hilly and elevated country, as a rule, however, is better suited to grazing than to cultivation. Hence, unless forested, it tends to be used for grazing cattle, sheep or goats, these animals assuming relatively greater importance in the order named as the country grows more rugged or hotter and drier. Pigs are found in such conditions only to a limited extent. Level country when well watered and neither too hot nor too cold can usually be used for either cultivation or grazing.

The factors which determine the development of animal husbandry on well watered plains in the temperate region are complex. In addition to the influence of the economic development of the country there is the factor of the relative productivity of the land under different systems of use. As temperate plains vary in natural productivity their most profitable use changes. Lands with less than ten inches annual rainfall are usually too dry to be used profitably for any cultivated crop under ordinary conditions. The natural herbage can frequently be utilized profitably in such conditions by animals who harvest it themselves. At the other extreme are some of the rich meadows of England which are said to be so valuable for grazing that it is unprofitable to cultivate them. Meadows where the water is normally near the surface, such as the dikes of Holland, are also unsuited for anything but grazing. The same is true of some higher lying lands in very rainy countries. Between these two extremes there is considerable variability in the relative value of the land for various purposes. Dr. O. E. Baker has pointed out that in the United States animal husbandry based upon grazing becomes less productive more rapidly on approaching the dry lands of the west than does the raising of crops. Comparing humid and fertile regions of the east with semi-arid lands of the west the productivity of pasture lands decreases to one-tenth of its better rate while crop pro-

duction decreases only about to one-third or one-quarter.[4] In the light of such evidence it is clear why some of the very best lands of England are kept under grass in spite of the fact, as Sir Thomas Middleton points out, that ordinary land gives a much greater yield whether of human food or forage when it is under cultivated crops.[5] This combined evidence shows the inefficiency of ordinary pasture for raising animals rather than any inefficiency in animal industry in itself. Eventually, as economic conditions warrant it, less and less of the moderately good flat lands will be kept under ordinary pasture and animals will be fed on artificially produced forage.

Too cold or too hot climates affect the animal industry both directly and indirectly. The animals which are the best meat producers in temperate climates do not thrive so well under other climatic conditions. The cold or heat in itself is a handicap. Reindeer are suited to Arctic conditions so far as any animal can be and may be as good meat producers as can be expected for such conditions. Eventually it is to be anticipated that breeds of animals suited to the tropical climate and yet good meat producers will be developed, but that accomplishment is for the future. Extremes of temperature produce their greatest effects, however, indirectly. The lack of good fodder in the north and the coarseness of much of the herbage in the tropics are very real problems. In the tropics a still greater problem is that of disease.

AREAS AFFECTED WITH DISEASE

Disease has been a severe handicap to the development of the live-stock industry in all lands and climates, but

[4] O. E. Baker, unpublished MS., submitted as Doctoral Dissertation, pp. 32-47.

[5] T. H. Middleton, "Systems of Farming and the Production of Food," *Journal of the Board of Agriculture* (Eng.), 1915, pp. 520-533.

it is fairly well under control now in most of the temperate lands. Formerly severe epidemics caused ravages in the herds of Europe. To-day conditions are better, but the problem still remains. North America has not been so severely handicapped, but some diseases are troublesome enough even here. Asia and Africa are so overrun with animal disease that radical improvement of the stock is exceedingly difficult. The native stock is more or less immune to the effects of the epidemic diseases, but the presence of these diseases makes it exceedingly difficult to establish better breeding stock from outside regions. The problem of disease increases as the climate becomes warmer. Some diseases grow more common and destructive with greater heat and other new ones are added to the dangers. The tick-borne diseases appear as the warm countries are approached, and as the torrid regions of Africa are entered the disease carried by the tsetse fly is encountered. As civilization advances and the wild beasts are killed off, nomadic herding stopped, the forests cleared and the stock better cared for and kept clear of parasites by dipping, these diseases become less destructive. Such changes come slowly, however, and disease will be a limiting factor in Asia and all tropical countries for many years to come.

THE INFLUENCE OF IMPROVED BREEDS

One of the greatest factors in developing the modern meat-producing industries is the art of those who have developed efficient breeds of meat-producing animals. No new species of animals have been domesticated since the dawn of history, but the newer breeds are so far advanced beyond their predecessors, that, practically speaking, they are new types of animals. The development of these better breeds and their utilization in various parts of the earth are outstanding factors in the expansion of meat produc-

tion. The question of breed in the production of meat is of the utmost importance. Few phases of the subject are more carefully studied and dealt with by the practical farmer, but the subject has not been sufficiently emphasized by most of the writers dealing with the possibilities of the maintenance of the world's food supply.

A bare statement of the numbers of the animal population is insufficient to give us full information as to the meat-producing capacity of a country. A two-year-old prime British steer equals in weight of carcass three five-year-old steers in parts of Brazil, besides being of better quality. There are three fundamental facts in the comparative economic production of meat which we need to know in addition to the number of the live-stock population: we need to know the weight of the animals at time of slaughter; the age at slaughter, which shows the proportion of the herd slaughtered annually; and the ability to make flesh out of feed economically. The use of animals of the high-class breeds tends toward greater efficiency in all these matters. The aim of the breeder of meat-producing stock is to get a type of animal maturing quickly, giving a large carcass with the highest possible percentage of the cuts of the best quality, and, while eating more heartily than some scrub animals, making the most efficient use of its feed.

The lead in developing the modern productive breeds of meat animals was taken in England in the eighteenth century. Up to that time cattle had been valued chiefly for their work in pulling the plow and in producing milk. Sheep were raised almost solely for their wool. Prizes were offered for oxen of the longest legs to serve them in best stead in the miry roads. Marshall said of the Warwickshire ram in 1789: "A naturalist would have some difficulty in classifying him; and, seeing him on a mountain, might have deemed him a nondescript, a something between

a sheep and a goat. His skin might be said to rattle upon his ribs like a skeleton wrapped in parchment."[6]

Robert Bakewell (1725-1795), a Leicestershire farmer, was the leader in the movement for the development of efficient breeds. He began his work before the middle of the century and others soon followed his lead. There can be no question as to the poor yield of the carcasses marketed at the beginning of that century, nor yet of the very great improvements made before its close. It is possible that the chroniclers exaggerated slightly who maintained that the average weight of beeves at Smithfield market rose from 370 pounds to 800 pounds, calves from 50 pounds to 148 pounds, and lambs from 18 pounds to 50 pounds, between the years 1710 and 1795, but this increased weight is certainly no exaggeration to-day unless in cases where lighter animals are preferred.[7]

Bakewell was the leader in the utilization of inbreeding to develop and fix desirable characteristics. Previously, any controlled breeding had been between two alien stocks. He bred "in-and-in" using the finest animals of the same family which he had chosen as the best. Thus he fixed the type which he chose to develop and perpetuate. A cross-bred animal may have all the appearances of the desired characteristics, but it is almost certain to lack fixity of type and its progeny show reversion. Below the qualities which appear are others biologically hidden which may be very undesirable and these are almost certain to appear in a considerable proportion of the progeny. In the case of inbred animals there are less of the hidden characteristics present and what exist become more completely submerged by the inbreeding; thus the type becomes fixed and the characteristics are more certainly propagated.

The movement having been started, it gathered momen-

[6] R. E. Prothero, *English Farming, Past and Present*, pp. 181, 186.
[7] *Ibid.*, p. 188.

tum and soon all the agricultural regions of Great Britain from Devonshire to Aberdeen were engaged in improving their live stock, either selecting and improving from that type which had become native to their local conditions, or bringing in new blood from some strain already improved and developing fixed breeds from these crosses. Bakewell, the leader, was a yeoman farmer, but the movement was taken up and advanced by the landed gentry. All leading agriculturalists were interested. Changing economic conditions in England demanded a more efficient agriculture. The growth of population demanded better sustenance, and transportation conditions at the beginning were insufficient to enable them to draw freely from the outside. Later, when better transportation was developed, it became a struggle between industry and agriculture for labor; poor farming could not compete with good manufacturing. The increased development made it impossible for poor domestic farming to compete with imported foodstuffs. When the corn laws were repealed and grain was imported freely, the farmers turned to live stock, the domestic production of wheat being no longer profitable. When meat was imported, they turned to still better live stock and succeeded in the face of competition with local manufacturing for the attention of labor, capital and brains, and with the cheaper natural resources of the New World in the production of foodstuffs. The result was not retrogression, but development. There was a leading class of citizens thoroughly interested in the land and agriculture, men who had plenty of leisure and intelligent foresight. To them commerce held only a second-class appeal. Their brains were devoted to agriculture, and the results are very evident. As a result, we find to-day the leading names of high-grade live-stock breeds throughout the world are largely those of the British shires in which they originated. The Spaniard developed the Merino sheep for fine wool,

and the leading types of lard hogs were developed in the Corn Belt of the United States, but the leading meat breeds of cattle, sheep and hogs and some of the best dairy cow and horse breeds originated in Great Britain and were developed largely in the eras of the greatest competition which agriculture has experienced, the early movement coming before the Napoleonic wars and the time of greatest improvement coming in the third quarter of the nineteenth century when foreign meats were already being imported.

The lard type of hog has been developed chiefly in the United States where there is an abundance of corn for feed and where the demand is for lard and fat bacon rather than for lean pig meat. The other meat-producing animals in this country have largely originated from the British breeds of stock.

The degree of distribution of these various meat-producing breeds is not at all easy to determine with statistical accuracy. It must be recognized that there are other breeds which possess great merits and are used near their site of origin. These breeds which are best known in the English-speaking world and in South America do not constitute any considerable part of the live stock of the continent of Europe, and yet these countries possess large flocks and heards of valuable breeds suited to the needs of the regions. Asia and Africa have breeds and species of their own which are inferior as meat producers. The foundation stock for the improved herds and flocks of live stock on which the commerce in meat is founded, with the exception of the American hog, consists largely of the breeds which have originated in Britain, partially because these breeds are largely British and commerce, especially in meat, has been largely in the hands of the British during this last century; but the merit of the breeds in question is the chief reason for their widespread distribution since they possess sufficient superiority over others to justify

their shipment to distant lands to improve the native stock.

Figures of the extent of the use of purebreds are not available for most of the meat-producing countries. The data which are available indicate that, even in the more advanced countries, much yet remains to be done in building up the existing flocks and herds to the level of the present stage of development of high-class breeds. However, the stock of most of the countries which are commercially engaged in meat production is largely improved by the admixture of a certain amount of the blood of the better breeds. Organized measures are also being taken in many countries to extend the use of better breeds.

One serious obstacle in the way of the wider distribution of better blooded stock comes from the prevalence of diseases that are more fatal to purebreds than to the native scrub stock. This obstacle is most serious in the tropical and subtropical regions of the earth.

In some parts of Australia and South America great things have been hoped for from the introduction of Zebu blood from the herds of British India. The Zebu is not an efficient animal in itself as a meat producer, but it is immune to fever and it transmits its immunity to a crossbred offspring. A cross between a Zebu and a high-class beef breed is said to make a valuable meat producer. This Zebu is a humpbacked tropical species of cattle common in India and seems more immune to insect life, particularly the tick, and to tropical diseases, than other cattle. It will thrive and fatten where other stock will starve, being extremely hardy under tropical conditions. The cross is to cattle what the mule is to the horse, only it is fertile and, consequently, allows greater possibilities for future development. To what extent this cross is capable of retaining the desirable qualities of both parents —the hardiness of the Zebu and the good flesh qualities of

the pure-bred steer—is a matter of dispute. An example of such a cross with a Shorthorn bull on a Zebu cow of about 350 pounds dressed weight gave a live weight up to a long ton and a dressed weight of 1,270 pounds. The flesh was said to be of good quality and the fat evenly distributed as in a good beef animal. On the other hand some accounts of meat from such animals describe it as being coarse. What results may be obtained from a further breeding and selection is hard to tell as yet. The British have developed breeds to suit each section of their own small country. It would be very strange if these breeds were the optimum for widely divergent parts of the earth. Each section of the world may have to develop its own best breed from the mixture and development of the strains existing in its own land. It is indeed reassuring that a cross with such different species as the Zebu and the European cow has been found at the same time to be fertile and to transmit good qualities from both sides. It would seem but a matter of time until the tropics were conquered for the ox. Time alone will tell what may be done in developing types of animals which will be resistant to other diseases, but to conquer the tick fever would be a great accomplishment.

Recent reports of success in propagating the reindeer in the Arctic regions of North America are almost more optimistic than the accounts of the Zebu crosses and must not be taken too seriously, in view of the slow growth of vegetation in the north.

CHAPTER IV

TYPES OF MEAT PRODUCTION

THE great share which the open range played in the production of meat, during the last half century with its ever increasing new lands, firmly implanted the idea in many minds that the supply of such food belongs to the exploitive stage of agriculture rather than the constructive stage. Many are firmly convinced that, with the passing of free natural feed, the production of meat will be curtailed. The density of the live-stock population in such countries as Belgium shows that by no means all the animal industry depends upon that type of winning food from nature which has been termed "agricultural mining." Meat animals are to-day being fed profitably upon artificially raised feed, both on farms where such feed is raised and on farms where some of the feed is bought. The history of such countries as England and Denmark shows a wonderful degree of success in the competition between such intensive methods of meat production and those based upon the wild feed of nature. A review of the statistics of the distribution of the live stock of the world shows that many sheep, a very substantial proportion of the cattle, and almost all the commercial pigs are raised in a system of agriculture which at least aims to maintain the fertility of the soil.

Man's earliest meat, doubtless, came from the flesh of wild animals which depended solely upon the feed supplied by nature without cultivation or artificial renewal. This source supplies but a negligible portion of human

food to-day, yet the original cattle of Texas and South America which supplied large quantities of beef were but one stage removed from wild animals thriving upon their native feeding grounds.

TYPES OF MEAT PRODUCTION VARY WITH STAGE OF ECONOMIC DEVELOPMENT

The types of meat production vary greatly with the stage of economic development in which a district is found. The old, but poorly developed, sections of Asia and Africa frequently have a nomadic type of life in which the human and animal population, chiefly sheep and goats, moves from place to place in search of pasture, with no settled abode. The new countries, as they have been developed by occidental civilization, usually turn first to extensive animal husbandry, with sheep in the ascendency in the drier regions. As the country develops, grain-growing on an extensive basis frequently supersedes animal husbandry for a time. In the course of a short time the one-crop system has to be abandoned and mixed farming brings back the live stock, this time on the general farming basis. As the population grows denser both the crops and the live stock are generally improved and a stage of intensive animal husbandry is reached in which a considerable part of the grain for feed may be purchased from other places and the live-stock industry becomes a quasi-manufacturing business. Much of western Europe is now in this more highly developed stage. These various stages are seen in a contemporaneous geographical survey and in the history of these European countries.

It might seem strange that animal industry based upon a careful maintenance of the fertility of the soil and using artificial feed alone could compete with meat produced upon the free range where no thought is paid to fertility.

When refrigerated beef commenced to appear in Great Britain, about half a century ago, the farmers were alarmed. The advent of modern transportation and removal of the corn laws had subjected the grain production to a destructive competition which was almost disastrous to British farming. Following that the farmers had turned to higher-class animal husbandry. It looked as though refrigerated beef from North America in the seventies and frozen beef from the southern hemisphere in the eighties would drive the Britishers from that class of farming also. An investigator sent out to study the new producing fields of the United States and Canada in 1877 reported to the British farmers that "the 'prime' beef of England and Scotland, which has its own particular patrons, will not be disturbed by the current from abroad and will find its way as quietly as before into British households. . . . And thus the imported beef must come into competition mainly with the third-rate and inferior varieties of British beef."[1] The Britishers heeded the advice and the succeedlng decades have seen a material increase in both quantity and quality of British cattle.

Doubtless, it is true that intensive production and free range feeding could not go on immediately beside each other. On the frontier land is cheap and labor dear. Under such circumstances the cheapest form of production is that which uses the free gifts of nature. However, the quality of product resulting under such conditions is not such as to present excessive competition to the high-class product of intensive agriculture. In most cases the fruit, cereals and other vegetable products of cultivation can readily compete with the wild products. The wild vegetation of nature is seldom so valuable for animal fodder as is the vegetation propagated by human effort.

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[1] James Macdonald, *Food from the Far West*, p. 299.

Certainly the type of animal found in the frontier countries is seldom comparable in productivity or quality to the animal found in intensive agriculture. The typical Brazilian beef, outside of the most favored section, gives about four hundred pounds of dressed carcass of indifferent quality after five or six years' growth. A good British beef animal produces a carcass of twice that weight and a very superior quality in two years. Each type of product, however, has its economies and its markets. Under the conditions of modern transportation the two have developed at the same time, in a state of balance, the range product increasing as new feeding grounds were opened up and decreasing as more settlers made a higher class of agriculture possible, the farm product being governed in its expansion by the supply of labor and artificial feed on the one hand and the demand unsatisfied by range-fed beef on the other. The relative proportion of the two has been governed mainly by the relative abundance of land and labor. The two types of production have also become complementary to each other, the poorer or newer lands producing young stock to be fattened on the higher-class farms.

FRONTIER METHODS

The methods of beef raising on the frontier of civilization on the open range in Africa and South America today are not far different from those employed in Texas half a century ago. There may not be so free a use of the picturesque six-shooter and lariat, but the counterpart of the cowboy is general. The stock is largely semi-wild and rangy with plenty of hide and bone but with little and poorer beef compared with a typical "prime" steer. No range has started off with high-class animals. The inferior types seem to stand the rigors of frontiering better than the higher-class animals. The present-day range also,

as the old Texas range, is exploited chiefly by the large landed proprietor with his herds of tens of thousands. The modern ranchers, however, are introducing high-grade blood from the leading meat breeds into their flocks and herds as rapidly as possible and enjoy greater advantages with the use of refrigerated transportation.

Perhaps as good an example of frontier ranching as any to-day is that of Rhodesia. There we find the native black boy used as a herdsman and perhaps a larger proportion of destructive wild beasts, but otherwise the development of the industry is typical of most ranching of to-day. Large companies, such as the Liebig Company, the Rhodesian Cattle and Land Company and the British South Africa Company, have acquired huge concessions there. Some of these concessions include at least 100,000 acres; one, at least, of the latter company includes a million acres. Smaller companies and individual ranchmen operate smaller holdings. These ranches are not yet, as a rule, filled to capacity. The largest herd at a fairly recent date consisted of about 28,000 head. However, the carrying capacity of the ranches is reckoned in some instances as at least 50,000 head. This puts them on a par with the Texas ranches at the time when American refrigerated beef first saw the British market. As in other places the foundations of the herds are native cattle, but better blood is being introduced as rapidly as possible, just as in Texas half a century ago. In some ways the methods of the Rhodesian range are superior to those of the earlier Texas days. Veterinary science has made strides in this last half century and the ranchmen are better able to cope with the insect pests and the diseases which they carry. On the other hand, in spite of modern science the South Africans have not made sufficient headway in conquering horse sickness to make it possible to utilize mounted herdsmen, and it is necessary to herd the cattle in small mobs.

Neither have they been able to make the strides in fencing in the range that Texas made half a century ago. There is a record of one fenced Texas ranch half a century ago of 210,000 acres.[2] The herds of wild animals charge into the African fences and destroy them. Nevertheless, in some sections fences are used to reduct the cost of herding the stock.[3]

A somewhat different type of range feeding of stock exists in the western part of the United States to-day. There millions of cattle and sheep are fed on the public range, Indian reservations and, under government supervision, in the national forests. One of the great tendencies there has been overstocking and consequent destruction of the native grasses and loss of stock in bad seasons. The stockmen do not own the land, but merely exploit the feed. Recent systems of supervision in the feeding lands of the national forests have kept the stockmen from overcrowding the feeding possibilities with the net result of a much greater carrying capacity in the long run.[4]

ANIMAL HUSBANDRY METHODS AND MIXED FARMING

When the stage of exploitation of nature has passed and animal husbandry finds its place with farming, many methods of production are found. Many farms scattered throughout the world raise just "cattle" of no definite breed, from which they get some milk and some beef. Some of this beef is slaughtered and consumed locally, but an appreciable amount finds its way to the stockyards whence it usually must be sent to a feeding district before it is fit for slaughter. What proportion of beef is so

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[2] *Ibid.*, pp. 24-54.

[3] A. W. Pearse, *The World's Meat Future*, pp. 223-239.

[4] Barnes and Jardine, "Live Stock Production in the Eleven Far Western Range States," U. S. Department of Agriculture, Report No. 110.

produced as a by-product of an indifferent class of farming is impossible to determine; it must be a great deal. The animals are pastured in back lots in the summers and fed largely on roughage during the winter until they are well grown, when they usually are somewhat fattened on grain. Many farms, however, produce beef in a business-like manner, some breeding and raising the animals and some buying thin cattle from the poorer farms and from the range, keeping them for a time and fattening them. Of course, between the type of farming which produces unquestionably scrub cattle and that which employs breeding or feeding stock of the highest quality, there is a great variation, making almost a continuous series from the worst to the best.

It should be noted that the animal industry of continental Europe still consists largely of what we may call triple-purpose beef production: meat, by-products and tractive power. There still, as in many parts of America a generation ago and some parts to-day, the ox, and sometimes the cow, is one of the main sources of heavy power on the farm. In some countries of southern Asia this third product of the industry becomes the foremost. Europe's example shows that it is not density of population which discourages this type of farm power—the opposite seems rather to be the truth—but there is a grave question as to its economy as compared with more modern methods of farming.

It should also be noted that a great deal of meat is produced as a by-product of the specialized dairy industry. Aside from the pigs which are fed on the skim milk and produce a very valuable adjunct to this industry under such conditions as the Danish, a great deal of veal and beef is made available for consumption. The veal in many cases is excellent, but the beef, coming as it does from the carcasses of the inferior animals culled from the herds

and from cows too old to milk, is distinctly inferior. The quantity of meat is not inconsiderable in spite of the light weight of the carcasses and the relatively small "turnover" in proportion to the animal population.

Those farms which make a specialty of raising beef animals are equipped with a breeding herd predominantly of some of the beef breeds. The milk of the cows is allowed to go largely, if not wholly, to the calves, the amount of milk taken from the herd for other uses being determined largely by the age at which it is desired to market the young beef, some of the best results being obtained on farms where half the cows are milked and the other cows feed two calves each, the calves receiving supplemental feed. On such farms the young cattle are usually grown partially on roughage and partially on grain until they are about two years of age, when they are fattened and marketed.[5] Formerly the animals were not slaughtered until a later age. Accumulated experience has shown the economy of early finishing.

It is questionable whether or not it is safe to mention any particular age as the normal age for finishing cattle. It is perfectly safe to say that range-fed animals are allowed to develop to much more mature years; frequently five or even eight years old in the frontier, but in the United States the cattle from the west are now usually sold for fattening at two to three years of age. The farm-raised animals also vary in age at time of finishing. Better-class farming tends toward earlier finish, while poorer farming and farms with plenty of cheap pasture raise the animals slowly on roughage. If any normal age be quoted for finishing other cattle than the extremes of the range and intensive production it may best be put at that

[5] Cotton and Ward, "Methods and Cost of Growing Beef Cattle in the Corn Belt States," U. S. Department of Agriculture, Report No. 111.

of the two-year-olds which includes those from two to three years.

The reason for this tendency toward earlier finishing lies in the greater growth economy of the younger animals when the cost of feed must be counted and when the time demands upon the land count. The economy of slaughtering animals while young has already been discussed.[6]

THE BABY BEEF INDUSTRY

There is an increasing tendency in the most advanced countries toward the production of so-called "baby beef" or highly finished beeves ready for the block at 12 to 18 months of age. As a rule these animals are bred and finished on the same farm, although some farmers buy their calves. There are two essentials for this industry: stock of high-grade, early-maturing beef type, and a high degree of skill on the part of the farmer in producing this type of beef. Plenty of high-grade feed is also a requisite, for in this industry the calf is never allowed to lose the fat with which it starts life, but is pushed constantly to lay on flesh of high quality. In spite of these added expenses in production, this class of beef is profitable on account of its superior market quality and the greater feed economy shown by the younger animals. Not only do the younger animals make faster gains, thereby utilizing less time of land and labor for their weight, but their amount of gain for feed consumed is strikingly greater. There is no other type of beef production less costly in amount of feed consumed for beef produced, but the quality of the feed is high, the stock must be superior and the highest skill is essential. The resulting beef dresses somewhat lower than older animals, but it shows a higher proportion of valuable meat and less inedible fat and waste. This type

[6] Page 51.

of animal industry is possible only where agriculture is well developed. Where there is an abundance of natural pasture it pays better to let the animal develop more slowly with less human effort. Where the feed supply is all artificial and the amount of labor per unit of land much greater, the greatest economies come from early development and the young beef industry should develop as rapidly as the farmers acquire the skill necessary for this type of production.

THE FEEDER INDUSTRY

Cattle are by no means always finished where they are raised. Animals raised on the best farms are seldom shipped elsewhere for fattening, but animals raised on poor farms and the range almost never acquire a real finish unless they are taken elsewhere to be fattened. It is doubtful if there are any real exceptions to this rule unless we admit to this class the alfalfa-fed steers of the American west and the Argentine, and even these are not equal in quality to grain-fed beef. Frequently the animals from the range or poorer farms are slaughtered in the unfinished state and their carcasses sold as inferior quality of meat, but for a long time regions abundantly supplied with feed have made a practice of buying such unfinished animals and fattening them for high-grade meat. The east of Great Britain and the Corn Belt states in America are the outstanding examples of this system of animal husbandry. In many instances greater profit is found in buying up the fairly mature but thin animals at the modest prices quoted for "feeders" or "stores" and fattening these rather than in raising the animals from a breeding herd. In feeding, the profit comes not only from the value of the added weight—this profit alone would seldom keep the farmer from bankruptcy—the profit comes as well

from the increased value of the flesh of the animals which was already formed when they were put on feed. It is improved quality of flesh in addition to the quantity which makes the industry profitable. The relation of the feeding industry to the fertility of the farms and the crop rotation is also a very important factor.

In the feeding industry the animals are usually brought from a distance, perhaps having been handled through several stockyards. Sometimes they are shipped thousands of miles by rail or boat. The British "stores" come chiefly from the highlands and from Ireland. Canada was an important source before 1896 and has recently renewed her shipments. In the United States feeders come from the mountains, the range and Canada, the northern cattle making the best gains when brought south for feeding. Naturally, there are real economies in fattening the animals where food is most abundant, and in the United States the special feeding is largely done in the Corn Belt where concentrated feed is produced most cheaply. However, it is not safe to be dogmatic about any such rule, for the British fatten many cattle and their popular concentrated feeds are cotton-seed, linseed, peanut meal and corn, no one of which is produced at home.

No definite rule as to feeding can be laid down to show the typical method of fattening. The British and American methods are widely divergent. Different types of feeders require different methods of handling. Animals in good condition can be rushed while those which are thin are usually fed for a longer period. Age, breed and condition make great differences in the methods and results. In some places the steers are put on pasture for the summer where they make the cheapest gains, but frequently not the highest quality. In other places they are fed largely on grain, sometimes with hogs in the feed lot to conserve the waste. Just as in raising cattle, the system

of fattening in any region depends upon the relatively available supplies of land, labor and feed. Where land is more abundant the slower methods with less concentrates are used. Usually the requirements of the whole farming system develop methods which are not the most efficient from the standpoint of animal husbandry alone. A striking example of this is found in the Lancaster area in Pennsylvania where cattle feeding is an old established industry antedating even the tobacco of the region. There can be no question as to the thrift of the farmers, but the feeding industry is far from being conducted upon the most economical program of feeding alone. The steers are bought and sold largely at times which suit the program of the other phases of farming rather than as the advantages of the market dictate, and the length of the feeding time appears to be governed by the value of the manure for the crops rather than by the economies in rapid finishing.

The results from a shorter feeding time resemble those from the early finishing of all animals, the feeding time for fattening steers varying from 60 to 210 days. As a rule it takes longer to fatten young animals, since they show a marked tendency toward growth rather than fattening. For older animals the short feeding time is unquestionably economical. It requires more skill, but less labor, land and feed for a given amount of results.

Apparently there is a tendency not only to feed an unnecessarily long time, but also to feed more concentrates than are actually necessary to get results in regions where these concentrates are relatively more plentiful. The British live-stock producer has developed his industry to a science and for long has had to count the cost of imported concentrates. The best feeders in all lands use succulent feeds to reduce the requirements for grains, but the British have carried this method the farthest and, as all who know the British industry will agree, they have sacrificed nothing

in the quality of the meat in the use of this method. The typical ration for the fattening steer in Britain is composed largely of root crops, straw and such concentrated feeds as linseed, cotton-seed and peanut meal. Barley, corn meal and dried brewers' and distillers' grains are used to a certain extent, but the coarse grains are not used freely.[7] This tendency in feeding is marked not only in the fattening of "stores" but in the feeding of all classes of cattle and sheep. The root crops there take the place of ensilage in America. The small requirements for concentrates and the high yield per acre of roots and ensilage crops speak hopefully for the possibilities of meat production even in regions where there is no surplus grain. Intensive grain-fattening is carried on all through the Corn Belt and in some other regions in the United States. Perhaps the most highly developed example of this type of fattening is found in the Lancaster region of Pennsylvania where steer feeding is carried on in connection with the raising of tobacco. The following brief description shows how the industry is conducted:

Since the early days of the feeding industry in the Lancaster Area, the majority of stockmen have adhered to the "dry" method of feeding. The following is given as a typical example of this system.

The farmer buys his steers about the middle of October, purchasing good feeders of 950 to 1,000 pounds. The feedlot is in a sheltered position and is equipped with a metal drinking trough. The basement of a large barn is used as cattle quarters, the animals having the run of the lot and barn except during severe weather when they are confined in the barn and allowed outside only three times a day to drink. Two box stalls are reserved for any animals injured or "off feed." The cattle are first fed on whole corn, bran and a commercial dairy feed, the average allowance being four quarts of the mixture daily per head for about three weeks, the cattle being fed three times

[7] Henry and Morrison, *Feeds and Feeding*, p. 483.

a day. During the first six weeks of the feeding period there is added daily to the grain ration of each steer a small amount of a mixture of 25 pounds of sulphur, 25 pounds of epsom salts and 25 pounds of sifted wood ashes, the mixture acting as a conditioner and laxative which puts the cattle in good trim for the subsequent economical handling of their feed. After a month the amount of feed per steer is doubled and about Christmas time, when the new corn crop is seasoned, corn-and-cob meal is introduced into the ration instead of whole corn. About January first the cattle go on to full feed, at which time the average steer that weighs 1,050 pounds gets a daily allowance of 10 to 12 quarts of a mixture of corn-and-cob meal, cottonseed meal, bran and commercial dairy feed which is fed in three portions at 5 A. M., 11 A. M., and 5 P. M. In addition each animal gets one to one and a half bundles of corn fodder and all the hay it will clean up with a relish.[8]

Grain-fattening must be distinguished from intensive grass-fattening which is carried on so commonly in Great Britain. The care of the grassland used in such fattening and the care of the animals themselves call for very great skill. As a rule fairly mature animals are chosen for such fattening, since they are less liable to sickness under the intensive feeding. The following description of the work involved in maintaining the pastures at a high point of productivity is from the pen of one well acquainted with the situation:

The surface of these pastures has to be supervised and worked so as to keep them well covered with a carpet of grass that is sweet, nutritious and continually growing from April to the beginning of winter. Otherwise weeds will take the place of useful grasses and clovers. Much skill is required of the grazier in this respect; to keep down weeds requires constant care on all land, even on that under permanent grass. The roller and the harrow must be used at the right time of year so as to improve conditions for the more delicate of the valuable plants; and when

[8] Files of Bureau of Agricultural Economics, U. S. Department of Agriculture.

used with discretion the teeth of the harrow will check, and even tear out, some of the obnoxious ones. Later in the year the scythe will need to be used to cut back such weeds as the nettle, which on good land grows with an astonishing persistence. But, above all, judicious grazing must keep a thick, level, and evenly growing carpet of herbage on the land. It will only be thick when the small varieties—bottom-grasses, as they are called—cover all the spaces on the surface which the tall-growing top grasses leave vacant. To keep the sward level the fields must be so fed that no one particular kind of grass gets too high; on the other hand, it must not be eaten down so close as to damage or uproot any of the small but useful plants. A continuous yield can only be secured when the general good management insures that different varieties of plants with differing periods of growth are present, in their correct proportions, among the flora composing the growing pasturage. When all the management is good there will be a regular rotation of growth; the early growing grasses will be bitten off and succeeded by those that bloom later; while these are being eaten the later growing grasses will be mixing with the second growth of the earlier kinds, and so on. This succession can be helped by skillful manuring; a few of our practitioners know this and take full advantage of their knowledge, but too many are content, in their ignorance of the soil or of manures, or of practical botany, or of all three subjects, to go on without the great help which scientific knowledge can give the farmer.[9]

Perhaps the most intensive production of veal is practiced in the Netherlands. The following description of the process is cited by Henry and Morrison:

The new-born calf is placed in a stall 6.5 ft. long by 1.6 ft. broad and about 5 ft. high, the stall being so narrow that it cannot turn around, though it can lie and stand comfortably. The floor of the stall is of slate or perforated boards, and is littered daily so that the animal has a perfectly dry berth. The calf barn is kept dark. Two or three times daily the calves get as much milk as they will drink, and during the first 14 days only the dam's milk is fed. Eggs or other by-feeds are not given.

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[9] K. J. J. Mackenzie, *Cattle*, p. 24.

The calf consumes on the average about 34 lbs. of whole milk daily for the whole fattening period of 10 to 12 weeks, at the end of which time the veal is considered to be at its best. To prevent the calves from eating feed other than milk, they are muzzled if straw or other roughage is used for bedding. Finely ground shells and sand are given to prevent scouring. The dressed weight ranges from 187 to 220 lbs., or, according to Rost, from 220 to 330 lbs. One lb. of gain is made in the beginning from 8 lbs. of milk and toward the close from 12 lbs. The average being 10 lbs. The fat calf dresses from 55 to 60 per cent of its live weight.[10]

TYPES OF SHEEP PRODUCTION

The development of the sheep industry has been largely influenced by the fact that this is essentially a dual-purpose animal. Its wool or its carcass becomes the by-product as the prices for these products rise or fall relatively. In the earlier stages of a country's development wool is the more important. The advancing demands for meat and greater facilities for handling it have brought great pressure to bear upon the industry to divert attention to the carcass rather than the fleece.

The sheep is more of an omnivorous animal than the cow, eating, on necessity, what few animals but goats will touch. Partially as a result of this fact, the sheep has become more intimately associated with the range and highland feeding even than have cattle. It is a mistake, however, to assume that the sheep is necessarily associated with the range and not with that class of farming which perpetuates and improves the productivity of the soil. The fact is that sheep are the competitors of cattle throughout the whole classification of the latter industry from the open range to baby beef, not excepting even the dairy branch of the cattle industry. It is true, however, that

[10] Henry and Morrison, *op. cit.*, p. 488.

the sheep as a wool-producing specialist does not belong to high-grade farming any more than do dairy cattle to the range.

The range flocks of sheep are still in many cases composed mainly of Merinoes or other definite type of wool producers. Many range flocks, however, are composed of the mutton types or else of crossbreds containing a large share of mutton blood. In the western part of North America and in South Africa sheep raising is commonly conducted on the open range with the herding system. In this system one herdsman may tend 1,500 to 3,000 sheep. The sheep feed in close formation, usually with the same ones always in advance and another unchanging group in the poor feed at the rear. There are disadvantages to such a system, and the tendency is now toward the open flock system of feeding which can be developed in fenced pasture. In Australia and New Zealand the ranges are commonly fenced. This gives full opportunity to allow the sheep to scatter over the whole range so that all may be uniformly fed. It also has the advantage of saving the necessity for herdsmen and for driving the flocks to shelter at night. The extra costs of fencing, which are high, are said in Australia to be offset largely by the economies which come from this saving in labor and in the constant driving of the sheep. They have an added value in keeping out the troublesome rabbit of Australia and wild animals which prey upon the sheep. One of the greatest difficulties with the range feeding of sheep is the constant recurrence of short feed. Some countries experience this very severely in the form of a succession of dry years which necessitates killing a very substantial proportion of the flocks. Other countries are confronted more with annual shortages. It has been a very common custom from the early days of shepherding in Spain to have summer and winter feeding grounds. This custom

still persists and the herdsmen of western America and many other parts of the world drive their flocks from highland to lowland and back again with the change of the seasons. Even with this practice many sheep starve, but the custom of supplying auxiliary feed either from concentrates shipped in or fodder crops raised near the range is getting more common.

As is the case with cattle, many sheep are kept as an adjunct to general farming. Too often they are kept on the farm merely as a scavenger to eat weeds or to live on indifferent pasturage. However, in many cases even where no specialty is made of the sheep, sufficient attention is paid to them to render them important both for the individual farm and for the total production of mutton and lamb.

The British farmers have been noted for their sheep husbandry in conjunction with successful high-class farming. They have a method of keeping sheep throughout the season on green crops on which the sheep are pastured within temporary movable fences or hurdles. This method is particularly interesting in the light of the common idea that the sheep industry is fitted only for extensive agriculture, if even for any agriculture as distinguished from the range. The hurdling method is distinctly an intensive form of husbandry and supports several sheep to the acre.

Sheep and lambs from the range are shipped to the farm of the better developed regions and finished for slaughter somewhat as the cattle are. Formerly in the United States the feeding was carried on chiefly by large operators located near the large flour mills where the by-products of milling at that time did not meet with as ready sale as dairy cattle feeds as they do to-day. With the passing of this cheap feed, this type of the feeding industry lost popularity and the feeding was taken up

with considerable profit by the farmers of the northern part of the Corn Belt.[11]

This feeding industry, like the cattle-feeding industry, is conducted by the farmers at least partially for the sake of the improved fertility of their farms. The sheep is an excellent machine for turning roughage into meat and available plant food. It also can use concentrates to advantage.

The feeds used in fattening sheep are greatly varied. Sheep will thrive on a much wider range of feeds and shorter grass than will cattle. However, as a rule, the feeds used for the two classes of animals are about the same, only that cattle usually are fed more concentrates. The length of time required for fattening is shorter than is usual in the case of steers, very largely owing to the fact that about three-quarters of this class of animal are slaughtered as lambs. The sheep, as the steer, adds flesh fast while young, and the fat is not so important in the lambs as in the steers. In the United States lambs are most commonly fattened on corn and some roughage, preferably some kind of clover hay. In New Zealand the fattening is usually done on grass in the North Island and on root crops in the South Island. In Great Britain the fattening ration closely follows the rule for steers and consists chiefly of a large allowance of roots and oil-cake meal, though in some cases fair gains are made on roots and hay alone.[12]

The sheep industry even has a near counterpart to the "baby beef," *viz.*, the "hot-house" lamb. This so-called hothouse product is raised in completely unheated buildings or outdoors, deriving its name simply from the fact that it is a forced product for a fancy trade at a season

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[11] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 240.

[12] Henry and Morrison, *op. cit.*, pp. 521-547.

when the ordinary supply of lambs is low. In this limited industry the ewes are bred to lamb in the fall, making the lambs ready for market between Christmas and Easter. Needless to say, this industry, like "baby beef," demands a high degree of skill on the part of the caretaker.

TYPES OF PIG PRODUCTION

No other animal produces a given weight of carcass more economically than does the hog. He is easily made ready for slaughter early, thus wasting a minimum in mere vital functions. He also will freely lay on fat as well as flesh long before maturity is reached. No other domestic animal but the hen is so prolific, causing a relatively low cost for breeding and making the propagation of the most efficient types relatively easy.

In the case of the pig we have no range method of commercial production, but we have what is almost the counterpart in the "mast"-fed hogs of the south in the United States and in southern Europe. In this type of husbandry the pigs roam practically wild in the woods. The wild boar is not uncommon to-day in some parts of the earth and the "razorback" has not quite disappeared from some parts of the United States, but these play but a small part in commerce. The pig as a rule to-day is closely associated with farming and that of an intensive type.

There are two general types of swine produced: the lard type and the bacon type. The former is prevalent in the United States and Germany and the latter is the rule in many other countries, particularly the British Isles, Canada and Denmark. The lard type has been developed to its highest perfection in the Corn Belt of the United States, where the hog has had every opportunity to develop its propensity for laying on fat from the extremely fattening properties of the corn. The bacon type has been devel-

oped to its highest perfection to cater to the tastes of the British market which demands a "Wiltshire" side of relatively lean bacon.

While the hog is a scavenger, yet, not being a ruminant, it cannot thrive on a diet composed mainly of roughage suited to the sheep or steer. Pigs are raised with great profit on pasture and on roots, but their fattening requires a large amount of the concentrates other than cottonseed meal. The Danish are very successful in raising bacon pigs on roots, sugar-beet pulp, skim milk and some grain. The lard type is frequently grown on pasture of one kind or another and practically always fattened on corn. It is exceedingly common in the Corn Belt states when fattening cattle to keep a certain number of half-grown pigs in the feed lot to utilize the unassimilated waste from the feed of the steers. Thus a considerable saving is made and the pork crop increased. The hogs are also frequently turned into the ripe corn fields to harvest the crop. This method of feeding is called "hogging down corn." Another popular method of fattening is that of running the hogs in open pens with corn before them all the time in a hopper-like "self-feeder" from which they are allowed to eat at will.[13] Garbage also is the source of a great deal of pork. There are few farms which lack the help of pigs in utilizing garbage and similar waste products, and in some places an extensive pig-feeding industry is conducted on special farms with city garbage or brewery wastes. In Europe, in general, the hog is usually associated with the small farm and is fed principally on scraps, dairy by-products and other wastes, although in some sections, such as Denmark, the industry has been developed on a highly commercial basis.

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[13] *Agriculture Yearbook*, U. S. Department of Agriculture, 1922, pp. 181-280.

PART II

THE SITUATION OVER THE WORLD

CHAPTER V

THE UNITED STATES

THE United States is preëminently the world's greatest meat country. Production and consumption reach total figures greatly in excess of those for any other nation. The quality of the meat is excellent and the methods used in its marketing have been extended to other large producing countries. The leading place once held in the export of beef is a thing of the past and probably will never be recovered. The exports of pork products, however, are so large that until the year 1924 the United States was the world's leading exporter of meat.

CONSUMPTION

The national consumption of meat is estimated to have amounted to 17,520,000,000 pounds in 1925. Of this 10,272,000,000 pounds was pork including lard, 7,166,000,000 was beef, 1,004,000,000 was veal and 597,000,000 was mutton and lamb. On a per capita basis this amounts to a consumption of 63.1 pounds of beef, 8.8 pounds of veal, 5.3 pounds of mutton and lamb, 77.1 pounds of pork (excluding lard), and 13.4 pounds of lard in the year 1925.[1]

Regular annual official estimates of the consumption of meat have been made only since the year 1907. Unfortunately for any exact conclusions as to the trends of per capita consumption, this series of estimates is frequently

[1] J. Roberts, *Meat Production, Consumption and Foreign Trade in United States, Calendar Years 1907-1925.*

changed from the beginning. Certain broad facts stand out, however, in all the editions of these data. The consumption of beef has been declining on the whole since the beginning of these records, while that of pork has been increasing. Also from 1907 until about 1917 there was a pronounced decline in the consumption of meat in general, whereas the tendency from then until 1924 was distinctly upward. The quantities consumed in 1925 as given above, are below the high mark of 1924, but well above the low figures of a decade ago.

All meat and lard consumed in 1925 amounted to 167.7 pounds. This figure does not include the edible offals. The comparable figure for 1924 was 177.9 pounds, for 1917, 138.3 and for 1907, 179.2, according to the latest available estimates.[2] Estimates published in 1923 showed 179.8 pounds for 1907 and 183.4 pounds for the year 1923. An estimate made before the origin of the regular series, and as yet unrevised, showed a consumption of 181.5 pounds of meat and lard, excluding edible offals, in the year 1900.[3] It is apparent that the peaks of consumption have continued at about the same level during this past quarter century. The decrease culminating in 1917 accompanied a rapid decrease in the national surplus of beef and a rapid increase in the price of that kind of meat. The increase in consumption since then has been chiefly of pork, although beef consumption is now materially above its low point.

Before the recent recovery of approximately former levels of consumption, it was very commonly assumed that a permanently downward trend had been established. It is now evident that no strongly downward tendency has been permanently established during these last two de-

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[2] *Ibid.*

[3] G. K. Holmes, *Meat Situation in the United States,* pp. 116, 263, 272.

cades. This is especially certain in view of the fact that the live-stock population of the country was at a temporary peak about the year 1907 and the meat supplies must have been greater then than they were earlier. Comparison with consumption data for the year 1907 are with abnormally large figures.

Wastage in the use of meat has also certainly decreased during these recent years of high prices. These statistical data really show only the meat going forward for consumption. The actual human intake is always much less, due to loss of fat in cooking and various forms of wastage. No data on domestic wastage are available, but it is almost certain that it has been reduced very appreciably in this last decade. Commercial wastage is also being decreased and less of the carcass is now being used for other purposes than human consumption. This is notably true in the case of fats which modern packing operations are making available for human consumption in improved forms. With even a small saving from such quarters a careful study of the situation might show an actual net upward trend in the human intake of meat during these last two decades.

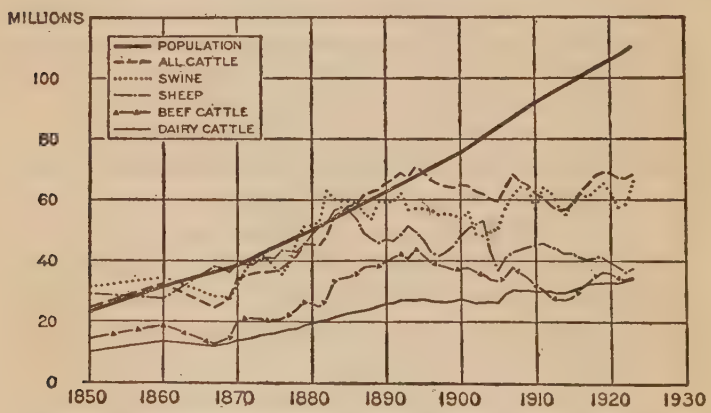
Of the trend of meat consumption in earlier days there is less certain knowledge. It has sometimes been assumed that the earlier trend of consumption was downward, for the number of live stock has failed throughout certain periods to keep pace with the growth of the human population and the records of colonial banquets give the impression of heavy meat eating. Neither of these supposed proofs of greater consumption in earlier days, however, is reliable. It will be shown later that in other countries the meat production of the flocks and herds has increased much more rapidly than the numbers in the animal population. Banquets and restaurant bills of fare are also uncertain indexes of the average consumption of a nation.

Data presented later show that in England, while the meat consumption of the banquet-eating classes has diminished, that of the masses has increased.

In order to shed light on the question of the probable trends of consumption in earlier years it is necessary to point out some changes that have taken place in production.

From 1840, the date of the earliest census records, until

CHART 5.—RELATION OF POPULATION TO THE NUMBER OF CATTLE IN THE UNITED STATES.



(From *Agriculture Yearbook*, 1923, p. 318.)

near the end of the century the numbers of meat-producing animals kept pace fairly closely with the increase in the human population. From the Civil War until about 1890 the per capita numbers of live stock were well maintained. During these last two decades, when, as already shown, the per capita meat consumption suffered practically no net decline, there was little or no absolute increase in the numbers of animals. Increase in consumption was made possible for the enlarged population by the greater productivity of the flocks and herds.

If the productivity of the live stock increased as rapidly in the last half of the last century as it did in the first quarter of this century, all meat exports could have been provided for after allowing a very materially increased per capita consumption. No certain evidence exists as to the rate at which the productivity of the flocks and herds did increase during that earlier period, but the increase must have been very considerable. As the Department of

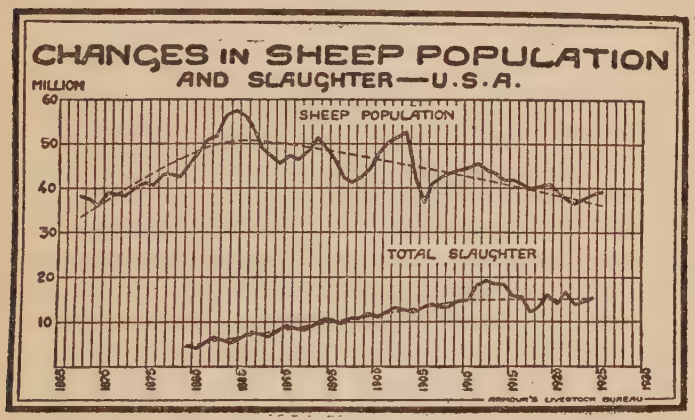


CHART 6.
(From *Profitable Sheep Husbandry,* Armour and Co.)

Agriculture says, "There has been a marked change in the character of the beef-cattle industry of the United States since 1850 with respect to the age which the animals destined for slaughter are kept on farms."[4] Shortly after the Civil War the Texas Longhorn became an important factor in the market. At first these steers were slaughtered at seven or eight years of age and gave no more meat than an average steer of to-day killed at half that age. Eastern beef also came to a considerable extent from oxen kept to seven or eight years of age. This slow turnover

[4] *Agriculture Yearbook,* 1921, p. 317.

gave a much smaller meat production per thousand animals in the herds than the more rapid turnover of to-day. This change began soon after the Civil War. The relatively unproductive Longhorns had disappeared entirely by the end of the century. Such improvements, of course, represent extreme cases, but made a large impression on the whole situation. During this earlier period the highly efficient hog industry of the Corn Belt became established. The sheep also became a producer of mutton and lamb instead of being raised almost exclusively for wool.[5]

Decrease in wastage was also very marked during this period, thus leaving more meat available for consumption. In the days of the early range the mortality of the animals was very high. The loss of animals through death and the loss of flesh in transit were also very great on both the early cattle trails and in the cattle cars when the animals were moved alive over many hundreds of miles. The advent of modern methods of marketing brought about by the packers saved enormous losses of such a character. Packing operations and changes in other industries also brought about great savings, particularly of fats. At the end of the Civil War animal fats supplied most of the material for illumination and lubrication and soap was made from fat now used for oleomargarine. Modern marketing methods have also made greater annual consumption possible by making all kinds of meat available at all times of the year. Meat consumption was formerly largely a seasonal affair. Refrigeration and modern marketing have made it an important part of the bill of fare every day in the year.

While the available data are far from being adequate to give exact measurements, it would appear that the average annual per capita consumption of the masses increased

[5] Macdonald, *Food from the Far West*, pp. 46-51; *Agriculture Yearbook*, 1923, p. 277.

decidedly during the last half of the last century and was being well maintained, with fluctuations, in this century.

Meat consumption in the United States has, nevertheless, fluctuated considerably from year to year. Part of this fluctuation is due undoubtedly to variations in the production, larger annual yields finding increased consumption through lowered prices. There unquestionably, however, is some relation between the demand for meat and the changes in business conditions in the country. A study conducted under the supervision of the writer arrived at the following conclusions: the per capita consumption of meat is generally lowered during periods of business depression and unemployment; beef consumption is more stable than that of pork, the consumption and prices of pork being affected more quickly by changes in business conditions; and salt beef and pork and poorer classes of meat in general are relatively more popular in periods of depression and the fancy cuts and forms of meat are in greatest demand in times of prosperity.[6] Much work remains yet to be done in analyzing the factors which control the fluctuations in the demand for meat, especially the swings of popular demand from one class of meat to another.

There is a considerable difference in the meat-consuming habits of the various sections of the country. The following table presents estimates of the Department of Agriculture for the year 1920 [7] showing the differences of consumption by sections of the country in rural and urban communities. The use of pork and poultry is shown to be very much greater and that of beef much less in the country regions than in the city. Pork also is used more freely

[6] D. O. Hannaford, "A Study of the Importance of the Various Factors Influencing the Demand for Meat in Various Places, Particularly Boston, Massachusetts," Files of the New England Research Council on Marketing and the Food Supply.

[7] *Agriculture Yearbook*, 1920, p. 828.

in the south than in the north and beef more sparingly. The western section leads in the use of beef and the western and the North Atlantic sections lead in the consumption of both veal and mutton or lamb. When the relative densities of the population in various parts of the country are considered, it appears that more than 55 per cent of the beef and veal was consumed in the northeastern section east of the Mississippi and north of the Ohio River and the state of Maryland. Thirty-two per cent was consumed in the North Atlantic section alone.[8]

ESTIMATED PER CAPITA MEAT CONSUMPTION IN THE DIFFERENT SECTIONS OF THE UNITED STATES, IN POUNDS

Class	Total	Beef	Veal	Mutton	Pork	Poultry
Urban						
North Atlantic	166.8	64.0	13.5	10.9	61.5	16.9
North Central, east	176.8	75.6	11.6	7.3	69.3	13.0
North Central, west	181.4	77.5	11.7	6.8	67.2	18.2
South Atlantic	158.4	55.1	5.7	5.4	76.3	16.0
South Central	178.4	66.1	4.4	8.7	79.7	19.5
Western	177.8	76.2	16.3	13.6	60.5	11.2
AVERAGE	171.6	68.3	11.8	9.3	66.3	15.8
Rural						
North Atlantic	174.7	47.1	10.7	7.6	85.5	23.9
North Central, east	196.2	48.3	7.2	5.8	109.9	25.1
North Central, west	212.7	57.4	6.3	3.8	113.1	32.0
South Atlantic	172.4	28.5	3.2	4.4	117.6	18.7
South Central	182.4	28.6	1.7	6.9	121.3	23.9
Western	188.2	64.7	9.3	15.8	81.5	16.9
AVERAGE	187.1	41.6	5.4	6.5	109.7	23.9
Total Population						
North Atlantic	168.8	59.6	12.8	10.0	67.7	18.7
North Central, east	186.0	62.7	9.5	6.6	88.5	18.7
North Central, west	202.3	64.1	8.1	4.8	97.8	27.4
South Atlantic	168.9	35.2	3.8	4.7	107.1	18.0
South Central	181.6	36.3	2.3	7.3	112.8	23.0
Western	183.1	70.3	12.7	14.7	71.3	14.1
AVERAGE	179.9	54.0	8.4	7.8	89.6	20.2

[8] *Agriculture Yearbook*, 1921, p. 314.

There are also great differences in demand inside of each section of the country. These differences are due in part to the economic status of various social classes, in part to the racial customs of the various elements which now make up the nation and in part perhaps to community customs. In studies conducted in Boston under the supervision of the writer very great differences in consuming habits were found which were related to these factors. The people in the wealthier classes were found to eat considerable beef, but little pork. The use of pork was found to increase relatively to other meat as the scale of income went down, excepting, of course, in the case of the Jews who eat little or no pork. The people of the Jewish sections eat relatively but little meat of any kind, but those who can afford it buy fore-quarter beef of good quality, and chicken is very popular among this racial class. The Irish sections were the heaviest consumers of meat, using 4.34 pounds per week per person and the Italian the lightest, using but 1.6 pounds. The Italians eat but little beef, confining their consumption chiefly to veal, pork and chicken. The Negroes were found to be light users of meat.[9]

The average housewife is increasingly calling for lighter cuts of beef. This necessitates the slaughtering of cattle at an earlier age. Veal is also used to a greater extent. The meat from the heavier and fatter animals is demanded chiefly by the high-class hotels and restaurants in the large cities.[10] It is easily possible, in fact probable, that the increasing popular demand for smaller cuts is due not so much to a decrease in actual consumption as to a decrease in wastage. The high prices of meat have made the house-

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[9] G. W. Tasker, "A Survey of the Consumer Demand for Meat in the City of Boston, Massachusetts," Files of the New England Research Council on Marketing and the Food Supply.

[10] *Agriculture Yearbook*, 1921, pp. 313, 316.

wives more careful to buy only such meat as they are certain can be consumed.

Suggestions are frequently made that the average consumption of meat in the United States is too high. This question, just as that relating to milk consumption, should be considered not so much from the standpoint of average consumption as that of the consumption of the less favored classes of the population. An average national use which is elevated by the heavy consumption of certain classes does not help the situation of the poorer elements of the population which get too little meat, especially during periods of depression. It has already been noted that even in the year 1918, in which there was a relatively large consumption of meat, the average consumption of protein among the laboring classes in the larger cities of the country amounted to only 87 to 117 grams per day as compared with an intake of 100 grams recognized by some of the best authorities as the minimum amount required to maintain the highest bodily vigor in ordinary circumstances.[11] When whole laboring communities in a year of prosperity and universal employment are found to consume only 87 grams of protein and some of the racial groups within these communities are shown to be very much smaller consumers of meat than the average, the natural conclusion would be that the national supply of meat is too low rather than too high.

PRODUCTION

The production of meat, including lard, in the United States is estimated to have amounted to 20,184,000,000 pounds in 1925. Of this 9,210,000,000 pounds were pork, 2,224,000,000 pounds were lard, 599,000,000 pounds lamb and mutton, 1,001,000,000 pounds veal and 7,146,000,000 pounds beef.[12] The value of these products greatly ex-

[11] See p. 39, *supra.*

[12] Roberts, *op. cit.*

ceeded that of the products of any other industry in the country excepting farm crop production. The value of the output of slaughtering and meat-packing establishments was $4,246,291,000 in 1919 when the product of no other class of industrial establishment equaled three billion dollars.[13] Part of this value was due, of course, to the hides and other by-products. However, these census data do not include the value of the animals slaughtered on farms. A large portion of the area of the country is also devoted to meat production. Of a total land area of 1,903,000,000 acres and an area of 1,666,000,000 acres employed for crops, pasture and forest, there are used for animal forage 587,000,000 acres in arid and semi-arid grazing land, 231,000,000 acres in humid pasture, 237,000,000 acres in woodland pasture and 257,000,000 acres under forage crops out of a total of 365,000,000 acres in all crops.[14] Of course, milk, wool, hides and other animal products than meat result from the use of this vast acreage, but meat production is the leading use.

The general trend of the numbers of each class of stock is shown in the chart on page 114 and has already been referred to briefly. In the last century the numbers of each class of animals increased so rapidly that, with an increasing productivity, an increasing consumption was provided for and a large export business was established. The more recent tendency, however, excepting the wartime movements, has been to allow the numbers of animals to decrease somewhat while increased productivity takes care of the increasing national demands. In pork only is there a real surplus produced to-day. Within recent decades there has been a marked tendency toward an absolute decline in the number of sheep, and beef cattle have

[13] Abstract of the Fourteenth Census of the United States, 1920, p. 918.

[14] *Agriculture Yearbook*, 1923, pp. 311, 416-423.

given place to a considerable degree to dairy cows. Pigs have increased slightly in this last quarter century, but throughout the past seventy-five years as a whole they have hardly kept pace with the numbers of cattle.

Live-stock production, as every other development, centered at first in the east. With the advancing decades it moved further west. The change has come, however, more from increase on the newer lands of the central and west-

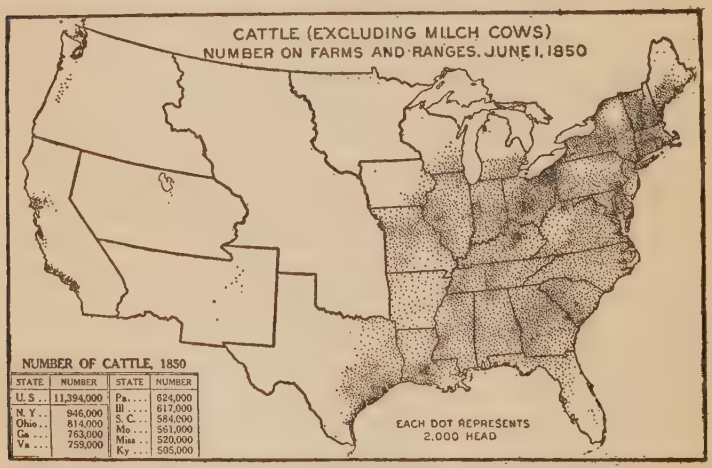
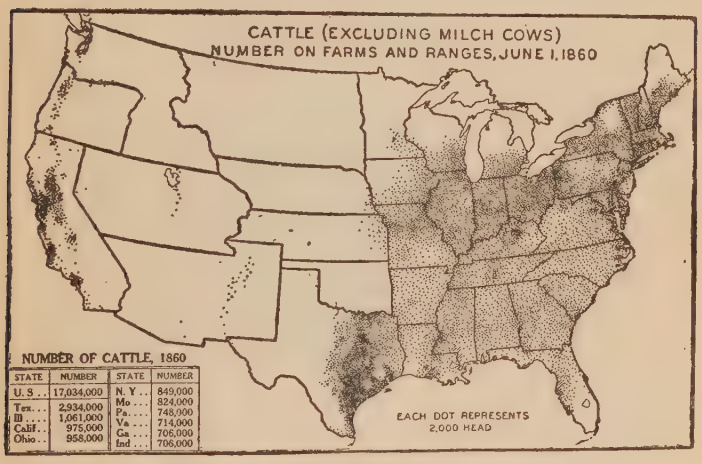


CHART 7.
(From *Agriculture Yearbook,* 1921, p. 236.)

ern parts of the country than from an absolute decrease in the east. Nevertheless, there have been notable decreases in the east. The New England states, excepting Vermont, have less cattle to-day than they had seventy-five years ago. Maine, Vermont and Massachusetts have increased their swine in the same time, while their neighbors have less now than formerly. The number of sheep has decreased markedly all over the extreme east. Cattle have increased in New York, decreased in New Jersey and for a time moved up somewhat in Pennsylvania to return to

about the 1850 mark in 1920. Swine have decreased considerably in New York and New Jersey and increased somewhat in Pennsylvania. The Southern states, which were devastated by the Civil War, as a rule lost heavily in live stock. The recent tendency in some of those states is to increase their cattle and swine, but the sheep have decreased rapidly. Cattle, hogs and sheep were all fairly well established in the eastern and central portion of the



STATE	NUMBER	STATE	NUMBER
U. S.	17,034,000	N. Y.	849,000
Tex.	2,934,000	Mo.	824,000
Ill.	1,061,000	Pa.	748,000
Calif.	975,000	Va.	714,000
Ohio	958,000	Ga.	706,000
		Ind.	706,000

CHART 8.
(From *Agriculture Yearbook,* 1921, p. 236.)

Corn Belt by the middle of the last century and cattle were just becoming established in eastern Texas and the Pacific coast. The succeeding decades saw the expansion of the sheep and cattle industry throughout the whole west in so far as natural conditions permitted such developments. The open range was developed throughout the western prairie after the Civil War and later gave way to settled agriculture in the best sections. The range has been so prominent in the development of the cattle and sheep industries that many find it difficult to think of the

continuance of beef and mutton production on any other basis. Cattle and sheep have been the advance guard of agriculture and this exploitive form of land utilization has become almost inseparably associated in the popular mind with these classes of meat. At the first of the century the greatest development of the beef industry was massed in a giant salient reaching southward through Kan-

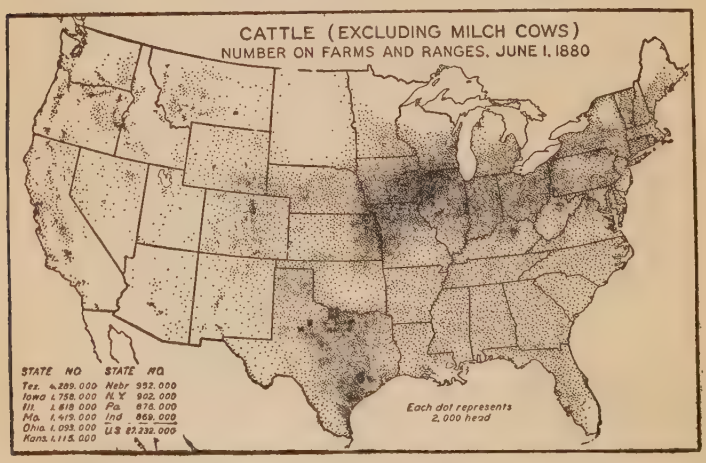


CHART 9.
(From *Agriculture Yearbook,* 1921, p. 237.)

sas and the center of Texas to the Gulf. By 1920 the relative importance of the southern portions of this salient had dwindled and the industry was centered in a district surrounding Iowa. By the end of the century sheep had become well scattered over the western mountainous sections with an important group in the Ohio district, and there has been but little change in distribution since then. The hog has been closely associated with corn production in the central portion of the country, known as the Corn Belt, since just before the Civil War. The chief move-

ment in this industry since that time has been the filling out of the area of this Corn Belt, thus increasing the area of this geographically specialized industry. To-day the Corn Belt is the great hog region, the leading beef region, especially for fattening, and a great center also for fattening sheep and lambs. The frontiers of the semi-arid plains and the rough country of the western mountains are

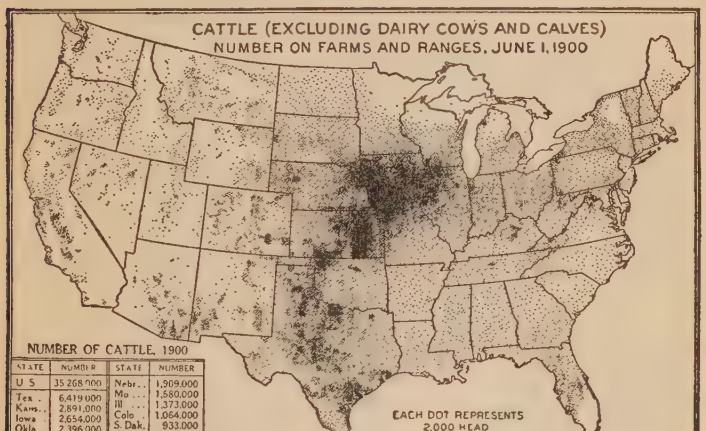


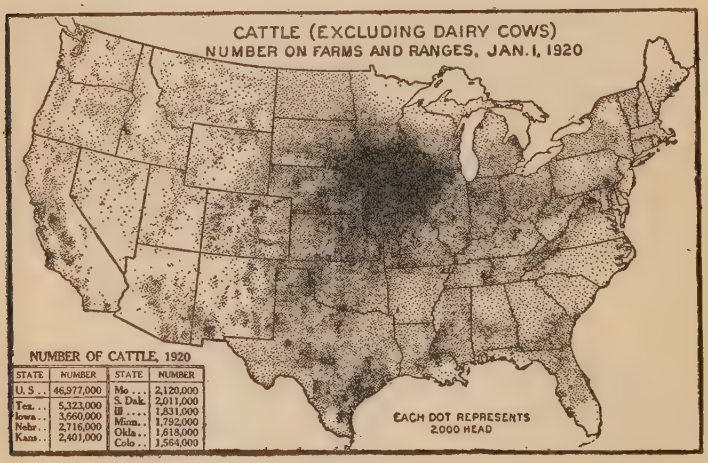
CHART 10.
(From *Agriculture Yearbook*, 1921, p. 237.)

great producers of young stock for finishing in the more fertile heart of the country.

THE BEEF INDUSTRY

The beef industry rests upon a strong demand for its product and also at present upon the ability of cattle to satisfy this demand through the utilization of coarse forage, much of which is grown on land as yet unprofitable for the production of direct human food. This form of the

industry has been of the utmost importance and may be called a supplement to the true agriculture of the country. It is still extremely important as compared with the other form of the industry which is more closely related to the production of cultivated crops and which utilizes the roughage incidental to direct food production, the coarse grains and other fodders grown in competition with direct human



STATE	NUMBER	STATE	NUMBER
U. S.	46,977,000	Mo.	2,120,000
Tex.	5,323,000	S. Dak.	2,011,000
Iowa	3,660,000	Ill.	1,831,000
Nebr.	2,716,000	Minn.	1,792,000
Kans.	2,401,000	Okla.	1,618,000
		Colo.	1,564,000

CHART 11.
(From *Agriculture Yearbook*, 1921, p. 238.)

food and leguminous crops grown partially to maintain the fertility of the soil. This latter form of the industry is increasing and will probably continue to increase, but the natural conditions of a great part of the United States are such that the former type of production must continue to be important even as agriculture becomes much more intensive.

The value of cattle and calves slaughtered each year represents 37 per cent of the total value of all animals slaughtered and wool produced. Beef cattle, being well adapted to rough land and sparse grazing, are the chief

means for producing food on about three-quarters of the total land area of the country. Much of this area is rough land, forest partially or wholly cut over and, most important of all, those parts of the western plains where the rainfall is too light for profitable cultivation but which produce a great deal of valuable forage. The contribution to the beef industry made by the smaller area of the culti-

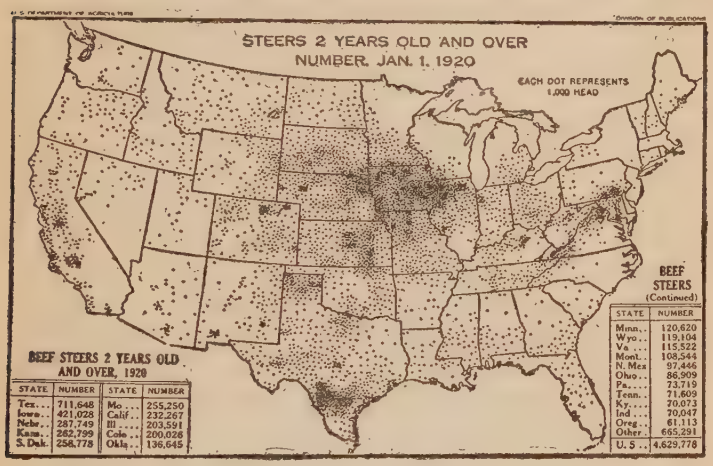


CHART 12.
(From *Agriculture Yearbook*, 1921, p. 249.)

vated land, however, is now greater than that of the vast areas of rough grazings.[15]

Until 1894 the numbers of cattle kept pace, as we have seen, with the growth of the human population. From that time on, the total number of cattle has not increased and the numbers of beef cattle have actually decreased, amounting to 3.6 per cent less in 1920 than in 1900. The production of beef and veal is estimated to have been 7,609,700,000 pounds in 1900,[16] 7,301,000,000 pounds in 1920, and

[15] *Agriculture Yearbook*, 1921, p. 227.
[16] Holmes, *op. cit.*, p. 263.

7,787,000,000 pounds in 1923.[17] While the total number of beef cattle has declined, the decline in the number seems to be due wholly to the earlier slaughter of the steers, with a consequently greater proportionate turnover of the stock. The breeding herd has increased materially. The number of cows two years old and over increased 17.65 per cent from 1900 to 1920. The number of calves under one year of age also increased in the same period, but only by 4.21 per cent according to census data.[18] There has been an increased slaughter of calves and the weight of the beef animals at slaughter is decreasing. However, there should be an increasing supply of beef and veal from the growing dairy herds. The great up-turn in the calf crop culminating in the year 1918[19] shows that the potential productivity of the breeding herds is not ordinarily utilized.

Beef production fluctuates in cycles. The receipts of cattle at Chicago show major up-turns every ten to fifteen years. The years 1883, 1890-92, 1903 and 1918 were years of unusually heavy receipts.[20] Comparing this fact with the statistics of cattle on the farms, it would appear that the heavy movements might be due either to large stocks, or the liquidation which comes with hard times. The heavy movements of 1918 corresponded to heavy stocks. The first half decade of the century was a period of declining stocks. The steady increase of over a decade was not liquidated until after 1894, and 1883 was a year of heavy increase in stocks after two or three years of a slowing up in the increase in the national herds.[21]

Registered purebreds constitute only three per cent of

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[17] *Agriculture Yearbook*, 1923, p. 1013.
[18] *Ibid.*, 1921, p. 317.
[19] *Ibid.*, p. 320.
[20] Hannaford, *op. cit.*
[21] *Agriculture Yearbook*, 1921, p. 319.

the total beef cattle of the country. Nevertheless, the influence of the improved breeds is much wider. Over 11 per cent of all farms reporting beef cattle have some purebreds, and many purebred cattle, especially in the west, are not registered. The influence of the improved breeds is so extensive that cattle of the old Longhorn type are a thing of the past and good "grade" cattle are very common. There, of course, is still great room for the extension of the influence of better blood. Shorthorns are the most popular beef breed, especially in the Corn Belt and the tier of states on the eastern edge of the Great Plains from Texas to North Dakota. Aberdeen-Angus cattle have about the same distribution, but are not so numerous. Herefords are very popular in the western part of the Corn Belt and thence west through the Great Plains and the mountains and particularly in Texas. In the southeast, where the cattle tick has been very troublesome in the Cotton Belt, Brahman cattle or Zebus have been introduced to a limited extent.[22]

The United States is divided into four general areas in the beef-producing industry. The western range takes in all of the country west of where the rainfall ceases to be sufficient for ordinary cultivation. The eastern boundary of this region stretches irregularly from the northwestern corner of North Dakota to the western shore of the Gulf of Mexico in Texas. The Corn Belt stretches eastward from this boundary to Ohio through the center of the country between the latitude of the southern shore of the Great Lakes and an irregular line parallel to this and halfway between it and the Gulf. North and east of this is the Appalachian and Great Lakes region and south of it is the Cotton Belt. Of these four areas the Corn Belt is known as the fattening area and the others as breeding areas for

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[22] *Ibid.*, pp. 239-244, 254.

the production of stockers and feeders. Nevertheless, some cattle are fattened in each region on either grain or grass and there is a greater density of breeding stock in the Corn Belt than in any of the other regions.

The larger half of the western range is still public land, much of which is used as grazing land for cattle and sheep. A great deal of it, of course, is privately owned and considerable areas are under cultivation. Part of the national forests is too densely timbered to afford real grazing opportunities and large areas are too rough and elevated or else too dry to produce forage. Large sections of the national forests, however, offer excellent grazing facilities on open grasslands as well as abundant browse. In the Great Plains regions, western New Mexico and Arizona, much of Nevada and of the Pacific states, cattle are grazed the year round on the range, commonly now with supplementary winter feed. The higher lands in the mountains afford summer grazing and the lower areas, especially toward the arid sections of the south, are used for winter grazing. Many of the herds are driven from one district to another with the change of the seasons. The number of cattle has increased on the western range in spite of the breaking up of many of the old ranches by homesteading. This whole region is a great source of feeder cattle and sheep for fattening in the Corn Belt, but many cattle are fattened locally, especially in the irrigated areas.

In the Cotton Belt proper only a few cattle are commonly kept on each farm. On the prairies of the surrounding areas in Texas, Florida and Louisiana, and on the cut-over lands of the coastal plains the cattle are handled in large herds about as they are on the western range. In central Texas and Oklahoma the cattle are raised in large fenced pastures with supplementary feed during the winter. In the mountainous regions the cattle are raised on small farms and wintered chiefly on cotton-seed meal,

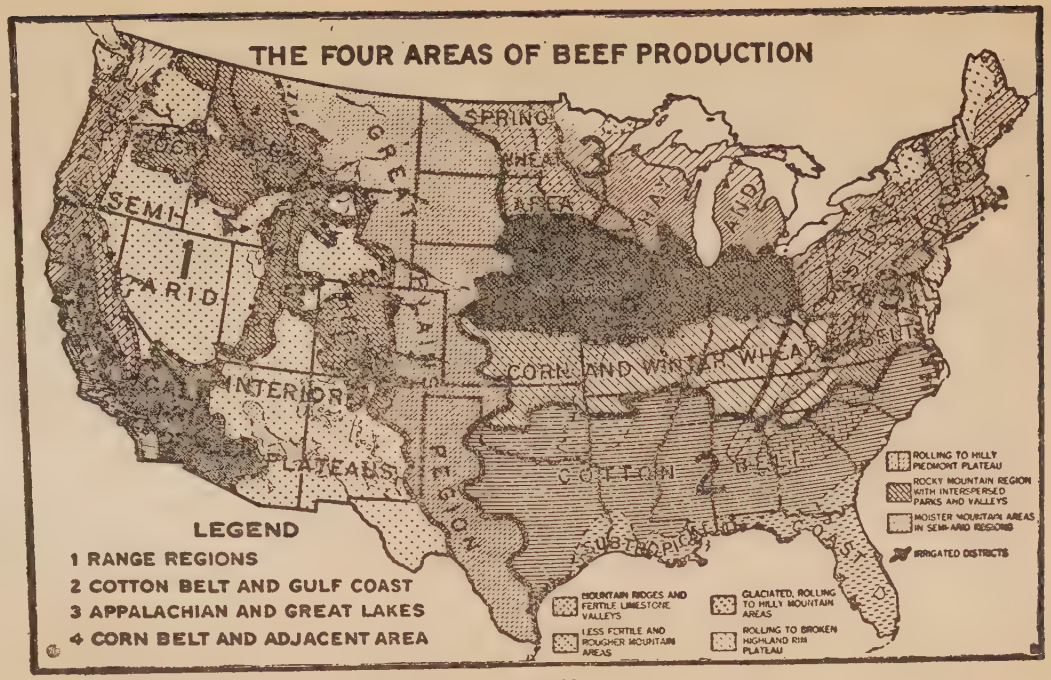

CHART 13.

(From *Agriculture Yearbook*, 1921, p. 246.)

silage, corn and cotton stalks and other roughage. On the cotton plantations the cattle are kept in woodland pasture and abandoned cotton and stalk fields. Some pasturage is usually available all the year, but supplementary feed is generally necessary to secure the best results.[23] Tick-borne disease has been very prevalent, but systematic dipping has halted the ravages of this pest and reduced the infected area. The quality of the cattle in the south is inferior to the average of the rest of the country, and beef is shipped in from the north for local consumption even though the consumption is lower than the national average and the number of cattle per head of the population is above the normal. The railway shipments of cattle from this section of the country are very small. The standards of efficiency in the industry are now somewhat similar to those common in other regions some decades ago. With the troubles in the cotton industry due to the boll weevil the recent tendency is to improve the live-stock industry.

There are very few beef cattle in the Great Lakes region or New England. New England and New York State have many dairy cattle, but the beef produced is of very low grade and many of the calves are turned into immature veal.[24] In the Appalachians quite a few beef cattle are raised on the upland pastures and marketed as grass-fed beef or fattened on grain in various scattered areas. The blue-grass pastures of this region give excellent feed and the fattening of feeder stock in the tobacco areas of eastern Pennsylvania produces a considerable quantity of high-grade beef.

The Corn Belt raises much of its own stock and it purchases large numbers of feeder cattle from the western range for fattening. Most of the land is fit for cultiva-

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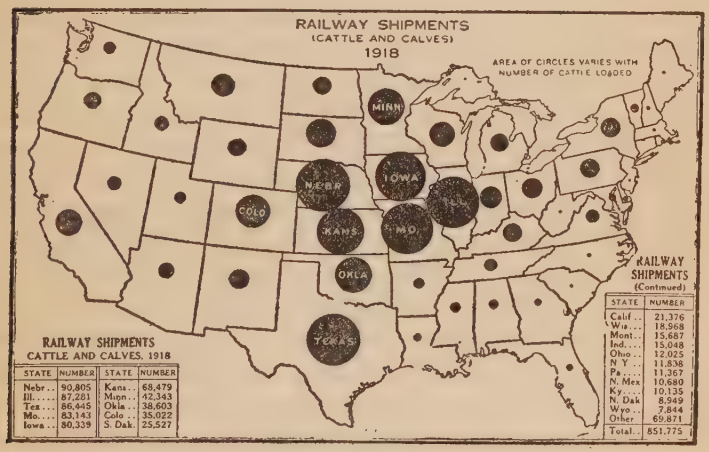
[23] *Ibid.*, pp. 245-264.

[24] R. J. McFall, "The New England Dairy Situation," U. S. Department of Agriculture, mimeographed bulletin.

tion, but considerable pasture is kept for the breeding herds and the cornstalk fields are used for forage in the early winter. The baby beef industry assumes some importance among the cattle raised in this region. Many two-year-olds are brought in every fall from the western range and fattened in this section. In central Kansas and southwestern Wisconsin some cattle are fattened on grass alone. As a rule, however, corn is an important part



STATE	NUMBER	STATE	NUMBER
Nebr..	90,805	Kans..	68,479
Ill....	87,281	Minn..	42,343
Tex...	86,445	Okla..	38,603
Mo....	83,143	Colo..	35,022
Iowa..	80,339	S. Dak.	25,527

STATE	NUMBER
Calif..	21,376
Wis...	18,968
Mont..	15,687
Ind....	15,048
Ohio..	12,025
N. Y...	11,838
Pa....	11,367
N. Mex	10,680
Ky....	10,135
N. Dak	8,949
Wyo..	7,844
Other	69,871
Total..	851,775

CHART 14.
(From *Agriculture Yearbook,* 1921, p. 280.)

of the ration which also includes grass, clover, alfalfa, silage and various other feeds.[25] This is preëminently the region of cattle fattening, although some animals are shipped through the central stockyards to the feed lots of the other states. About 20 per cent of all cattle and calves received at the 67 stockyards of the country are reshipped to the country as stockers and feeders.[26]

The accompanying chart showing the railway shipments

[25] *Agriculture Yearbook,* 1921, pp. 260, 261.
[26] *Ibid.,* p. 286.

by states gives a fairly clear idea of the relative importance of each state in the commercial beef industry.

The widespread territory and various conditions under which cattle are finished for the market tend to a considerable extent to make the market receipts somewhat more even throughout the year than they otherwise would be. There is a very heavy market movement, however, in the fall, culminating in October when the grazing is past in the greater part of the country. Part of this heavy fall movement consists of stockers and feeders which are largely absorbed by the feeding industry of the Corn Belt. Grass-fed cattle from the winter grazing lands of the southwest begin to move in June. The feeders bought in the late fall are marketed again in the spring before this crop from the southwest invades the market. Thus the supply of the better grades of cattle is remarkably even throughout the year. Irregularity of shipment of cows is chiefly responsible for the heavy fall movement of stock. The remarkable system of stockyards throughout various sections of the country does much to maintain the even supply of beef on the country's markets. Stockers and feeders are taken from surplus breeding grounds when the grass has passed for the season and are distributed all over the country to places where the cattle are fed and placed on the market when it would otherwise be short. The different seasonality of shipment from various regions, which is in some cases quite extreme, is also averaged upon the national market by reshipments and by the widespread distribution of slaughtering establishments associated with the more important stockyards.

During these past few years the cattle industry has been in a state of depression. For a decade before the war prices of cattle had been rising very much more rapidly than the general price level. During the war cattle prices rose with greatly increased rapidity, although more slowly

than general prices. Credit was extended to the cattlemen most liberally and every encouragement was given to the industry during the war, for the Allies were largely dependent upon North America for meat in 1918. In 1920 cattle prices broke seriously and went below the 1913 levels in 1921. Needless to say, even current costs of production could not be adjusted so quickly, and few businesses suffer more severely from the fact that an inventory of great value must be carried for a long time. This is particularly true of the breeding part of the industry. Feeders carry their stock for three to six months. Breeders must carry their stock for years. The loss of capital was more serious than the slowness in adjustment in current costs, for much of the capital was borrowed and was not liquidated with the sale of the stock at ruinous figures. The feeders suffered but mildly compared with the breeders of the western range.[27] The financial difficulties of the latter are gradually being resolved and the comparative price levels are in better adjustment than they were in 1921. The industry is not yet, however, considered to be in a very prosperous condition.

PORK PRODUCTION

Pork production is even more important than that of beef in the United States and has increased considerably since pre-war days. The output of the hog industry has expanded sufficiently rapidly to take care of an increasing domestic demand and provide a large surplus for the export market. This has occurred with a moderate increase in the number of swine in the country. In 1900 there were 62,868,000 head reported by the census. In 1907 there were estimated to be 61,300,000; in 1919, 65,300,000; in 1923, 71,500,000, and in 1925 only 56,700,000

[27] John Clay, *My Life on the Range,* pp. 356-365.

head.[28] The production of pork, including lard, in 1907, is estimated to have been 8,978,000,000 pounds; in 1918, 10,687,000,000 pounds; in 1923, 13,571,000,000 pounds, and in 1925, 11,434,000,000 pounds.[29] These figures show an increase of only 17 per cent in the number of swine from 1907 to 1923 and one of 51 per cent in the output of pork. Since there was no liquidation of hogs in 1923 to account for the heavy marketing it is very evident that the industry became more efficient during the period. There has been somewhat of a decline in the industry since 1923.

Hog production is very widespread throughout the country, yet its greatest development is concentrated in the Corn Belt. Three-fourths of the farms of the nation raise hogs and 10 per cent of the value of the total agricultural production comes from the hog industry. Most of the hogs whose carcasses get into national and world trade are raised in connection with the corn crop and nearly two-thirds of these hogs are raised in the Corn Belt. Thirty to forty per cent of the nation's corn crop is marketed in the form of hogs.[30] Since the hog is an efficient user of concentrated feed, whether clean grain or wastes, rather than of the bulkier roughage consumed so largely by cattle and sheep, the raising of these animals is closely associated with true agriculture and not with the range.

The concentration of a large number of hogs in the Corn Belt was noticeable in 1880 and a certain tendency in this direction appeared as early as 1840. Since 1880 the concentration has spread into the western and northern parts of the Belt and has decreased in the sections closest to the corn markets. The numbers on the farms all over

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[28] Roberts, "Food Animals and Meat Consumption in the United States," U. S. Department of Agriculture, Department Circular 241, p. 3.

[29] Roberts, *Meat Production, Consumption, and Foreign Trade in United States, Calendar Years 1907-1925.*

[30] *Agriculture Yearbook,* 1922, pp. 181, 182.

the country outside of the extreme east have increased, especially in the dairy sections north of the Corn Belt which produce butter and have an abundance of skim milk for feeding. The industry does not flourish particularly in the districts which produce fluid milk for city consumption, nor is there in any section the strong connection between the swine industry and dairying that is found in Denmark. Less than 5 per cent of the hogs of

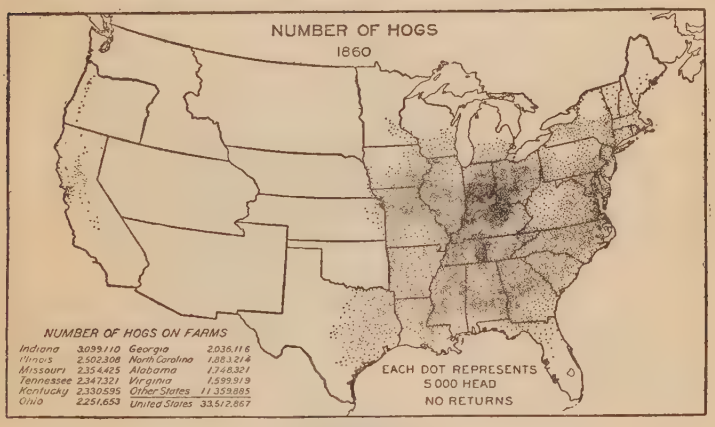

CHART 15.
(From *Agriculture Yearbook*, 1922, p. 188.)

the country are raised in the dairying section of New England, New York and Pennsylvania combined. In the dairy sections near the Great Lakes pigs are more popular.[31]

The widespread raising of swine on so many of the farms throughout the country is due partly to the fact that these animals are valuable converters of waste products into good meat and lard. It also is due to the fact that pigs slaughtered on the farm are a popular source of the farm meat. Hogs are raised and slaughtered for home meat

[31] *Ibid.*, p. 209.

supplies in practically every county in the nation. Under such conditions the hog assumes an important place in the farm economy particularly in the provisioning of the family.[32]

The hogs slaughtered on farms in the year 1919 were about one-quarter of the number raised in the whole country. The greatest number of hogs slaughtered on the farms is found in the south in the Cotton Belt and neighbor-

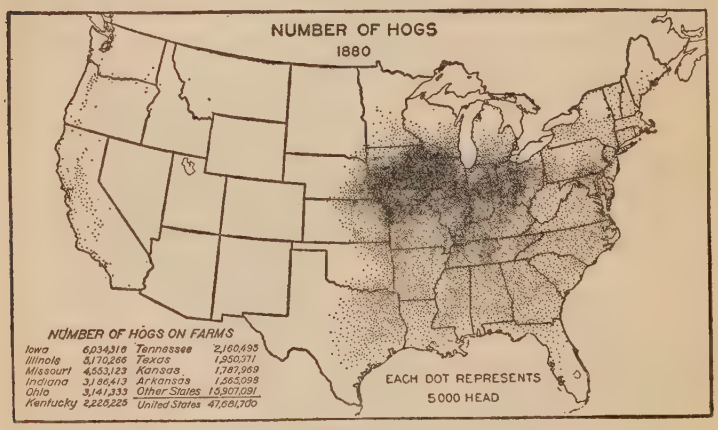

CHART 16.
(From *Agriculture Yearbook*, 1922, p. 189.)

ing sections where pork is a very important part of the diet. Commercial development of the industry has been retarded in the south because of the emphasis laid on the growing of cotton. Ravages of the boll weevil in this crop have recently driven the farmers toward greater diversification of their business and for some time it has been realized that some change in the farming system was necessary to check the process of the reduction of the productivity of the soil. In some sections the hogs are given the run of the woods, where they pick up what they can,

[32] *Ibid.*, p. 200.

and the animals that are not lost or stolen provide a cheap meat supply for their owners. The quality of this meat, of course, is poor. Under southern conditions, pigs may be run on the pastures almost the entire year and require only a moderate amount of concentrated feed for finishing. Peanuts and velvet beans are used extensively as hog feed. The animals are allowed to clean up the peanut fields after harvesting and in some cases this crop is

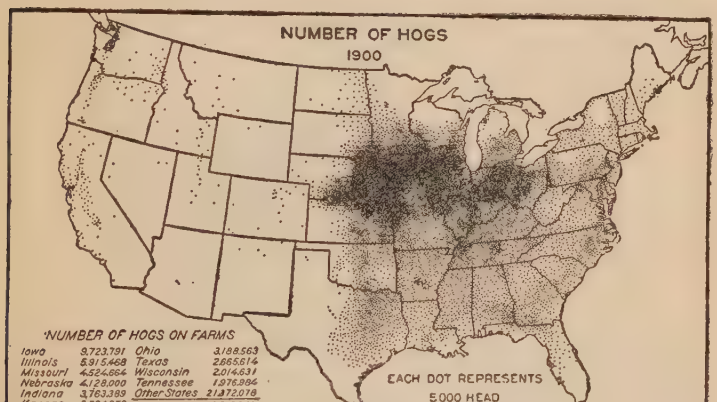

CHART 17.
(From *Agriculture Yearbook*, 1922, p. 190.)

grown just for hog pasture. This feed is said to produce "soft pork" in which the fat or lard is oily at ordinary temperatures. Corn is also raised extensively in the south as a hog feed.[33]

The commercial hog is raised in the Corn Belt and is a "fat hog" as distinguished from the "bacon pigs" of Britain and Denmark. The combination of the American type of hog and the soil and climatic conditions of the American Corn Belt makes producing conditions for fat pork that cannot be surpassed in any country in the

[33] *Ibid.*, pp. 206-208.

world. Conditions are ideal for this type of meat production and the farmers of that section have developed a high degree of skill in the industry and a type of hog that suits their conditions.

Even in the heart of the Corn Belt there are few farms where hog production is the sole important source of income. Iowa has the greatest density of hog population, but the average farm there derives only about two-fifths

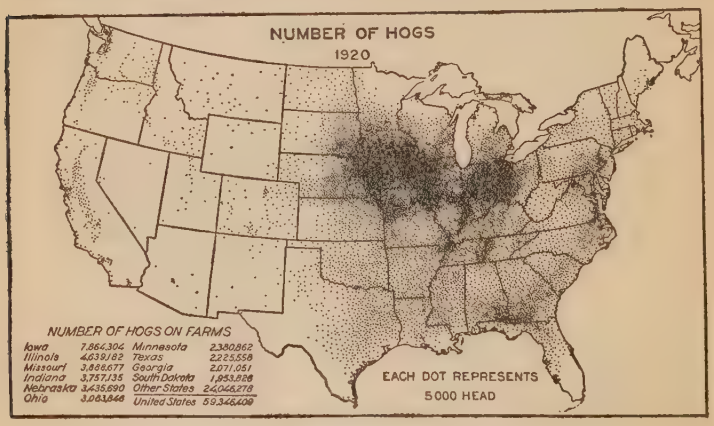

CHART 18.
(From *Agriculture Yearbook*, 1922, p. 191.)

of its income from this industry. As a rule in this section there is a rotation of crops in which corn, small grains and clover or alfalfa take their places. Young hogs are pastured to some extent on the clover, but this crop with other hay goes mostly to cattle and horses. The hogs also are less well able to utilize the cornstalks than are the cattle. However, the practice known as "hogging down corn" has become very popular, and when these animals are allowed on only a small portion of a field of standing corn at a time they clean up the whole crop thoroughly, stalks as well as ears. This is a cheap and

effective way of harvesting the crop. Hogs are also put in the feed lot with the fattening cattle and clean up the corn and other feed wasted by the other animals. Hogs being fattened for market are usually fed liberally on corn and other concentrated feed. A device known as the "self-feeder" has become very popular. This keeps grain before the animals continuously and they help themselves at will. Studies of the Department of Agriculture indi-

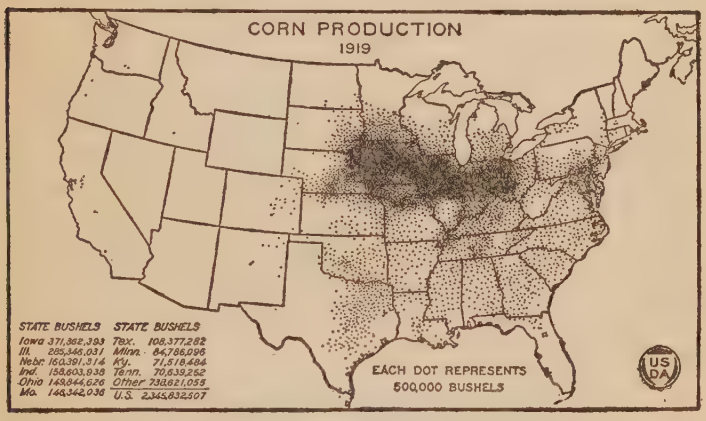

CHART 19.
(From *Agriculture Yearbook*, 1922, p. 210.)

cate that besides a certain amount of forage from the pasture, the number of bushels of corn consumed by a herd of swine for 100 pounds of pork varies from 4½ to 16½ with an average of 8¼ bushels. The feeding of corn to hogs tends to steady the rate in which this crop reaches the final market. In a rough way the pork production follows the corn crop, but a large crop may not be consumed within one year.[34]

The bulk of the hogs of the Corn Belt are raised on the farms which finish them for market. Nevertheless there

[34] *Ibid.*, pp. 182, 209-214, 225.

is a definite trade in feeder pigs weighing 75 to 100 pounds. More pigs can usually be fattened in the Corn Belt than are raised there, and there are some sections in the west and southwest where pigs can be started profitably on pasture or other feed and sold as feeders, but cannot be fattened profitably.[35]

The American farmers have developed their own hog breeds to a great extent and the characteristics of those breeds fit the requirements of the country. A larger proportion of the hogs are purebreds than that of any other kind of live stock. Three and five-tenths per cent of the hogs on the farms on January 1, 1920, were registered animals. These, of course, were practically all breeding stock, for animals being raised for slaughter would not be registered. Many of the farmers use purebred breeding stock, and, in consequence, many market hogs are purebred though not registered. There are, of course, many purebred breeding animals unregistered. It is evident that an important part of the country's stock of swine is purebred.[36]

It is estimated that about 80 per cent of the hogs marketed pass through the public stockyards. These market places are scattered throughout the country, but the most important ones for the industry are in the Corn Belt. The hogs are usually shipped to these stockyards by train and slaughtered in near-by packing plants, but an important number are reshipped to the eastern cities before slaughtering. Owing to the concentration of the commercial producing industry in one region the market movements are quite uneven throughout the year. Fortunately, the cured meat can readily be kept in storage and sold to consumers as it is required.[37]

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[35] *Ibid.*, p. 198.
[36] *Ibid.*, pp. 194-196.
[37] *Ibid.*, pp. 231-248.

Much remains yet to be done to fit the production to the demand throughout a series of years. A comparison of corn and hog prices for a series of years shows that there are violent recurring fluctuations of the relation of one price to the other, and yet the value of the corn is the chief element in the cost of the pork. It would appear that these fluctuations were due largely to waves of optimism and pessimism on the part of the farmers. Approxi-

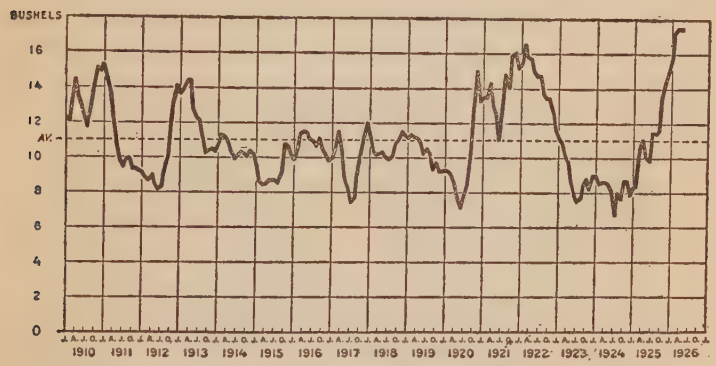

CHART 20.—CORN AND HOG RATIO, 1910 TO DATE.
(From *Crops and Markets,* April, 1925, p. 119.)

mately every three years the price of hogs gets high in terms of corn and then plunges to a low ratio and thence again to a high level in another three years. These waves of unprofitableness are comparable to the waves of depression in the general business world.[38] Postwar deflation in 1920 produced one of the most violent drops in hog prices on record. Corn went down in price more rapidly at the same time and raised the purchasing power of hogs in terms of corn.[39] The purchasing power of hogs in terms

[38] H. A. Wallace, *Agricultural Prices,* pp. 30-35.
[39] *Crops and Markets,* U. S. Department of Agriculture, April, 1925, p. 119.

of other commodities in general declined drastically, although to no lower level than had been common a generation ago.[40] The effect upon the producers was very unfortunate, but the rapid turnover in this industry made the depression less severe and of shorter duration than the troubles which overtook the cattle breeders of the west.

THE SHEEP INDUSTRY

The sheep industry of the United States does not hold a relatively important position in the meat industry of the

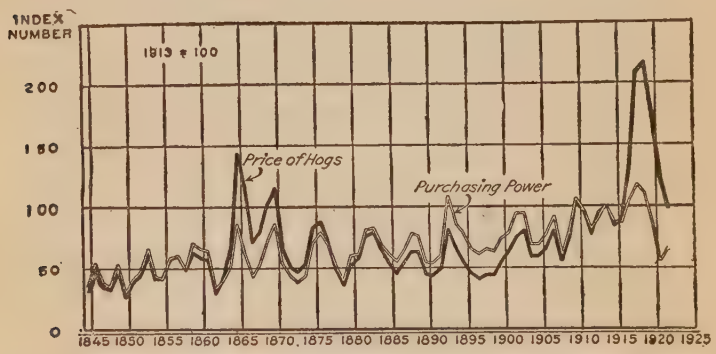

CHART 21.—PRICE AND PURCHASING POWER OF HOGS.
(From *Agriculture Yearbook*, 1922, p. 244.)

country. Only 599 million out of the national meat production of twenty billion pounds were mutton and lamb in 1925. During the past seventy-five years the production of meat has increased greatly in relative importance in the keeping of sheep. Formerly sheep were raised primarily for their wool. Now the mutton breeds predominate. Only 15.17 per cent of the purebred flocks are Merinoes and 27.07 per cent Rambouillets, and even the breeders of these types are now striving for mutton development and are

[40] *Agriculture Yearbook*, 1922, p. 244.

using crosses with mutton breeds, as yet less fixed in type, but otherwise similar to the Corriedale of New Zealand.[41]

Sheep are now raised principally on the western range, although there still are many in Ohio and the surrounding states. Texas also raises a considerable number and there are many scattered all over the country in small farm flocks. The industry as a whole has declined greatly in the past two decades, the numbers having fallen from 63,-965,000 in 1903 to 38,361,000 in 1924. The latter num-

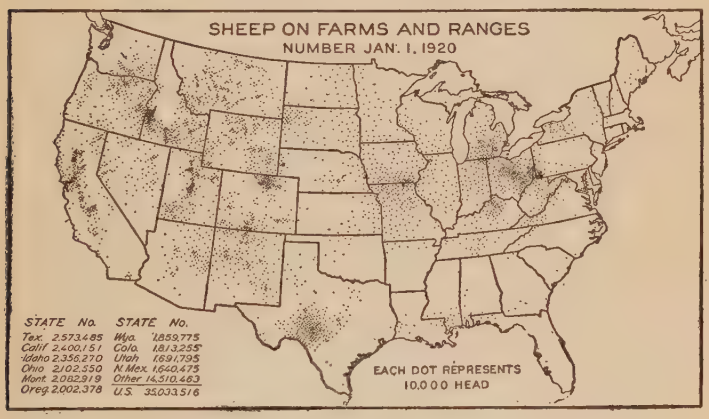

CHART 22.
(From *Agriculture Yearbook,* 1923, p. 240.)

ber is just slightly below that of 1867. The year 1903 was the high-water mark in the numbers of sheep, following a period of considerable fluctuations in numbers until the sudden increase in 1900.[42] In the earlier years sheep were supplanted in the east by dairying, while the numbers were increasing first in Ohio and the Lakes region and later on the western range. Before 1900 the Ohio district lost its relative importance. Recently the break-

[41] *Ibid.,* 1923, p. 245.
[42] *Ibid.,* p. 981.

ing up of the range into homesteads has not only taken much land for farming but in many places has made it more profitable to develop cattle rather than sheep on what is left of the free range on account of the fact that under range conditions sheep can be economically run only in comparatively large numbers.[43]

There are three distinct types of sheep husbandry in the United States: the maintenance of farm flocks, the grazing of large flocks on open range and the fattening of range sheep and lambs in the Corn Belt and on irrigated lands in the west.

The maintenance of farm flocks is fairly important outside of the more specialized dairy districts, particularly in rough hilly country. The sheep are usually kept on pasture as much as possible and given as little extra feed as possible. The lambs are usually born in the spring and marketed at the end of the pasture season. This is distinctly a scavenger industry utilizing rough pasture, weeds and other forage that would not be used otherwise. A variant is the raising of "hothouse" lambs, which are fall lambs forced for the late-winter and early-spring market. This form of the industry is more popular in Ohio and the east. Farm flocks are also assuming an importance on the irrigated farms of the west where there is waste forage and the conditions are not favorable to either beef production or dairying.[44]

Sheep are still very important on much of the western range. Formerly bands of two to five thousand were common and were raised strictly on the nomadic basis on the free range. Recently it has become almost necessary for the sheep owners to own or lease part at least of the land on which their sheep are run, and smaller flocks are the

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[43] *Ibid.*, p. 252.
[44] *Ibid.*, pp. 246-251.

rule. The best land with the most available water supplies has been taken for farming and the sheepmen have been pushed back to the rougher and more arid lands, moving from one section to another with the change of the seasons. Frequently water supplies must be secured by artificial means or at best by purchase or lease of land around the watering places. The national forests are used extensively for grazing, but to use these, sheep owners must have improved ranch property of their own. Moreover, much of the open range has been abused and its carrying capacity has diminished. As a consequence of these factors sheep grazing in the west has decreased in importance, although it is recognized that it would be possible to restore it at least partially under proper management of the grazing facilities outside of the national forests which are now managed carefully. The arid districts of the southwest suffer comparatively little competition from dry farming and the industry in that section has suffered the least changes.[45]

Specialized fattening for market was started in the eighties in the western part of the Corn Belt by large operators who purchased feed from the flour mills and fattened sheep from farther west. Later the fattening industry was taken up by the farmers, and, as the demand for lamb developed, lambs rather than sheep were fattened. To-day there are three main types of the fattening industry. In the Corn Belt lambs are turned into the cornfields and allowed to clean up the standing crop, stalks and all. Rape is usually planted with the corn to supplement the corn fodder. West of the Missouri River, where there is comparatively little stormy weather in the early part of the winter, lambs are fattened in open yards. The feed used is corn, alfalfa, beet tops and a certain

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[45] *Ibid.*, pp. 251-260.

amount of small grains. This practice is also followed in isolated spots in the far west in connection with irrigated farming. In the east central states, where there is much stormy weather in the fall and winter, barn feeding is followed fairly extensively in some sections.[46]

The sheep industry, as all others, suffered in the post-war deflation. The price of both wool and lamb decreased drastically in 1920 and 1921, but both markets recovered much more rapidly than the beef market and the sheep farmers aped the more severe financial distress which overtook the western cattlemen.

FOREIGN TRADE

The foreign trade of the United States in meats and live stock has no great importance at present excepting in the case of pork products. The exports of pork are so great, however, that the total meat exports surpass the total for any other nation. Beef exports were formerly very large, increasing in amount until 1906. From then until 1914 the net exports of beef and the equivalent in live cattle decreased rapidly, reaching a net import of about three hundred million pounds in the year 1914. During the war the exports were restored to fairly large figures, but failed to approach their former levels. Recently the net exports have been quite small.[47] Very little actual beef is exported, but there is a considerable export of beef fat. The foreign trade in mutton and lamb is small and has for years consisted mainly of imports.[48]

The United States is the world's leading exporter of pork products. These exports, which have been in existence since the eighteenth century, started to assume importance in the middle of the last century and rose very rap-

[46] *Ibid.*, pp. 240, 260-262.
[47] See pp. 576-583, *infra.*
[48] *Foreign Crops and Markets*, May 18, 1925, p. 595.

idly from 1869 until 1900. From then on until just before the war the trend was downward. During the war this trade again increased tremendously, reaching the large total of over 2,600,000,000 pounds in the year 1919. This record has not been maintained during these past few years, but the trade continues at a level about equal to the 1899 figure which was the maximum for pre-war years. Great Britain is the chief customer, but some of the continental nations are now heavy buyers, particularly of lard.

The subject of this country's foreign trade in meats has been so important in recent history that it seems best to treat it more fully later under the heading of International Trade in conjunction with the foreign trade of other leading nations.

THE FUTURE OF THE INDUSTRY IN THE UNITED STATES

The future of the industry in the United States gives no cause for serious misgivings. The trend of population growth assures an expanding home market that should eventually absorb all the production unless in the case of pork products and possibly some beef fat. During these past few years the various meat-producing industries have been experiencing a depression, but this should be only temporary. There is great need for more careful adjustment of supply to the demand in order to eliminate the costly effects of violent fluctuations in market adjustments.

There has been much question as to the ability of the farms and ranges of the nation to continue to supply the probable demand as the population increases. The remarkable expansion of beef and pork production during the war should dispel this question for the immediate future. The problem at present confronting the industry is that of a sufficient demand to absorb the existing output at a profit to the producer.

The idea is frequently advanced that the continued expansion of the human population will cause a larger proportion of the land to be used for the production of food directly available for human consumption. At present only about two-tenths of the land under crops is used for the production of such human food. About one-tenth is used for the production of non-food crops, such as tobacco, cotton and flax. The remaining seven-tenths of the crop land produces feed for live stock.[49] It is small wonder that those who prophesy the early advent of hunger from the pressure of human population on the soil count live stock as man's competitor for the product of the soil and assert that the live stock must in great part disappear.

In addition to the seven-tenths of the land in crops, the animals use 60,000,000 acres of humid improved pasture, probably 171,000,000 acres of humid unimproved grassland pasture, 237,000,000 acres of forest and cut-over woodland, besides about 587,000,000 acres of arid and semi-arid land in the west. Much of this land is relatively unproductive, but it is estimated that live stock consume about three-quarters of the product of the improved land, and nearly all the crops, other than timber, of the unimproved land. In the Corn Belt only 16 per cent of the crop land is used for direct human food and 84 per cent for feeding the animals. In the Cotton Belt only 53 per cent of the crop land is used for animals, cotton taking much of the land away from all food uses. In the winter-wheat region between these belts nearly 75 per cent of the land is used to support live stock. In the north and east sections about 69 per cent of the crop land is used by live stock. In the west only about 6 per cent of the land is cropped and three-fifths of this is devoted to forage rather than direct human food.[50] It is very evident that, if animals are really

[49] *Agriculture Yearbook*, 1923, p. 311.
[50] *Ibid.*, pp. 311-414.

competitors of man in a serious race for food and if live stock should and could give way to the production of food immediately available for man, there would be a very large leeway left for the increase of human food in the United States.

Such a shifting of the use of the land is hardly likely to occur, however, at least within the immediate future. The best evidence available indicates that the population of the United States is likely not soon to exceed two hundred million, unless some unforeseen stimulus to racial expansion appears.[51] The land of the country can readily support this number by the application of better farming practices already well known without giving up the relative importance of its meat production. Moreover, much of the land now used for fodder production is not as useful for direct human-food production as it is for its present use. It also appears to be true that the best farming practices require the continuation of live-stock production.[52] The foreseeable future calls for improvement in the efficiency of fodder production rather than supplanting it by a system of agriculture devoted chiefly to the production of direct human food.

The possibilities for increase in efficiency in fodder production in the United States have by no means been exhausted. The largest part of the land used for animals is in pasture. That portion of the pasture which is in the arid districts may be capable of but relatively little increase in productivity, but the humid pastures can very readily be improved. They are relatively neglected to-day and are only about half as productive as the pastures of western Europe. Even these latter are far from being

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[51] L. I. Dublin, *Population Problems in the United States and Canada;* Raymond Pearl, various writings.
[52] *Agriculture Yearbook,* 1923, p. 317.

as productive as they might be made. Animal husbandry in the United States is definitely turning more and more to dependence upon cultivated forage crops rather than native pasture.[53] This is a progressive and a necessary step. It involves more human labor per acre, but very much more animal produce per unit of land. This cannot be carried to all portions of the country. Some of the more arid and the rougher sections will continue in pasture, but other means of improvement are possible there.

There seems to be little likelihood that the producers cannot meet the expanding demands for meat for many years to come. The U. S. Department of Agriculture has estimated that the land resources of the country are capable of supporting 350,000,000 people with the average standards of production of Germany, the United Kingdom, France and Belgium, or 574,000,000 people with the more intensive standards of German production taken alone. These estimates are based upon the assumption that the consumption habits of the United States may be changed to those of pre-war Germany which used somewhat less meat, but a larger total food intake.[54] The more probable outlook is that the national population growth will stop short of either of these figures and that the meat consumption will be maintained at least on the present levels. The national production should continue to supply home requirements and give a surplus of pork products. Greater expansion of production than this will probably be discouraged by competition with other forms of economic development within the country.

Alaska

The territory of Alaska has only about one thousand cattle and as many swine with less than five hundred

[53] *Ibid.*
[54] *Ibid.*, pp. 497-500.

sheep.[55] Since 1891 reindeer from Siberia have been introduced successfully, Lapland herders having been brought in to show the natives how to handle the animals. It is estimated that there are now at least 200,000 of these animals in Alaska and a surplus of reindeer meat is available for export, samples already having been shipped to the United States.[56]

Porto Rico

The great development of the growth of sugar cane on the island of Porto Rico has tended to discourage the livestock industry. The latest complete data show 278,943 cattle, 4,140 sheep, 58,036 goats, and 136,810 swine in 1920.[57] The meat production from these animals is not sufficient to supply the local demands. In the year 1924, nearly 50,000,000 pounds of packing house and dairy products combined were shipped in from the mainland of the United States and nearly 4,000,000 pounds of meat and meat products were imported from other countries.[58]

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[55] *Ibid.*, p. 1031.

[56] *Report of Canadian Royal Commission on Reindeer, etc.* (1922), Appendix No. II.

[57] *International Yearbook of Agricultural Statistics,* 1924-25, pp. 201-213.

[58] Board of Engineers for Rivers and Harbors (U. S.), *Commercial Statistics for the Calendar Year 1924,* p. 1223.

CHAPTER VI

GREAT BRITAIN AND IRELAND

Great Britain holds a unique position in the world's meat industry, one entirely disproportionate to the size of the country. This position is due partly to the long-established importance of meat in the national dietary, partly to the fact that this country is the source of many of the leading breeds of meat-producing animals all over the world, partly because the industrialization of the country makes it the greatest of all markets for the meat surplus of other nations, and partly to the situation of its animal industry, in which are found examples of the highest development.

CONSUMPTION

Apparently the heavy meat eating which has been famous in British history was largely confined to the upper classes, for all available evidence goes to show that the average consumption of recent years is considerably higher than formerly. The discussions in the Royal Statistical Society make it perfectly clear that it is impossible to obtain reliable statistics on the average British meat consumption as far back even as the beginning of the last century.

Comparatively accurate estimates of the live-stock population of the country are available only for about half a century. It would appear from some fairly reliable early estimates that meat consumption has fallen off somewhat among the upper classes during the past century, but that it has increased decidedly among the laboring classes which

make up a much larger part of the population.[1] This tendency is particularly pronounced since the war.[2]

The following differences in consumption among various classes of the population, as found by the Royal Statistical Society in 1903, show a striking contrast between different classes of the population at that time.[3]

MEAT CONSUMPTION BY DIFFERENT CLASSES OF THE BRITISH POPULATION

Population Group	Pounds of Meat per Annum
Group I (*a*) Laborers	86
(*b*) Artisans and Laborers	107
Group II Lower middle class	122
Group III Middle class	182
Group IV Upper class	300

The Secretary of the Department of Agriculture and Technical Instruction for Ireland in 1912 is authority for the statement that whereas at that time the consumption of meat in the United Kingdom represented the expenditure of 21*s.* 7*d.*, forty years before it was only 2*s.* 6*d.*[4] Yet during those decades the price of meat had actually fallen on the average.[5] An estimate of the average annual consumption of meat by all classes in the United Kingdom gives 75 pounds for each person in the decade from 1851 to 1860. That was the decade when meat was

[1] R. H. Rew, "Observations on the Production and Consumption of Meat and Dairy Products," *Journal of the Royal Statistical Society*, Vol. 67, p. 421.

[2] *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries (1925), p. 1.

[3] "Second Report of Committee on Production and Consumption of Meat and Milk in the United Kingdom," *Journal of the Royal Statistical Society*, Vol. 67, p. 382.

[4] *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. 13, p. 20.

[5] *Minutes of Evidence Taken before the Departmental Committee on Combinations in the Meat Trade*, United Kingdom (Cd. 4661), 1909, pp. 254-256.

first imported and the imported supplies accounted for only 3 pounds per capita of this amount.[6]

In 1924 the average per capita consumption in Great Britain and Ireland was 127.3 pounds, of which 65.8 pounds came from imported supplies.[7]

This consumption figure for the year 1924 indicates that the average per capita use of meat had increased somewhat over that of pre-war years. If the year 1913 is taken to represent the pre-war period, the total meat available increased by 6 per cent while the population increased by 4½ per cent. This indicates a small per capita increase over 1913 which, as a matter of fact, showed an unusually heavy amount of meat used. On the other hand, it is said that an unusually large amount of meat is now wasted by the distributors, thus making less available for actual consumption. It is a question, however, if this so-called wastage in the trade is not in reality the result of the demand on the part of the public that, with high prices, the tradesmen trim off before sale what was formerly trimmed off and wasted in the kitchen. The general demand for smaller cuts or joints indicates a tendency toward less domestic wastage. Consequently, it would appear that, with the exception of mutton and lamb, more meat is actually being eaten by the British to-day than ever before. Certainly the poorer people are eating more than ever in spite of hard times. The statistics indicate a per capita consumption in 1924 of 63.4 pounds of beef, 22.1 pounds of mutton and lamb and 41.8 pounds of pig meat.[8]

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[6] Critchell and Raymond, *A History of the Frozen Meat Trade*, p. 2.

[7] Based upon total quantities of supplies given in the Report of the Board of Agriculture and Fisheries in 1925 on the *Trade in Refrigerated Beef, Mutton and Lamb*, p. 58, and a population of 48,068,000 as given by the *Statesman's Year-Book* for the nearest available dates to 1924.

[8] See pages 1 and 58 in the *Report on the Trade in Refrigerated Beef, Mutton and Lamb.*

Compared with the situation in other countries, the demand for pork in the United Kingdom is relatively low, although it is increasing, while the demand for beef is fairly high and for mutton and lamb is exceptionally great. While the consumption of meat in general is greater in the winter, the demand for mutton and lamb is comparatively keen in the summer, and bacon and other forms of pork take a larger part in consumption in the winter.[9]

Meat, exclusive of poultry, game and lard, accounted for 17.4 per cent of the nation's food in calories in the pre-war half decade, according to the calculations of the Food (War) Committee of the Royal Society.[10] The average Britisher eats about four times as much mutton and lamb and less than half as much pork as is consumed by the average person in the United States. A similar but more striking comparison exists in Germany. Moreover, when the Britisher does eat pork, he wants it lean rather than in the state of fatness demanded in Germany and the United States. Instead of a bacon which is largely fat, the English market demands a "Wiltshire side" which includes as one the ham, shoulder and side of a young and meaty pig. On the other hand, the Englishman wants his beef and mutton much fatter than such meats are usually eaten on the Continent. The Inter-Allied Scientific Food Commission computed the average beef in the United Kingdom in pre-war days to contain 22.5 per cent of fat as compared with 18 per cent in the other Allied countries and mutton to contain 30 per cent fat as compared with 24 per cent in the other countries.[11]

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[9] Report of Committee, *Journal of the Royal Statistical Society*, Vol. 67, p. 384.

[10] Committee of the Royal Society, *The Food Supply of the United Kingdom* (Cd. 8421), Appendix 1A.

[11] Commission Scientifique Interalliée du Ravitaillement, *Annexes au premier rapport*, p. 4.

In no country is there a demand for a more highly "finished" class of beef than in Great Britain. "Prime" beef cattle which are highly fattened produce a grade of meat in keen demand in certain circles. "Prime Scotch" beef from Aberdeen tops the London market. The British cooks have grown accustomed to using a superior quality of meat and are not skilled in making the best of an indifferent quality. In this respect Britain presents a contrast to the continent of Europe.[12] Another contrast is shown in the comparative popularity of chilled and frozen meat in Britain which was quite unpopular on the Continent until the necessities of war taught the cooks how to use it. In Britain the lesson was learned many years ago when a peaceful economic development brought about the importation of meat in the frozen state. While "prime" or highly fattened beef probably enjoys its greatest popularity on the British market, the average British consumer is manifesting an increasing preference for leaner meats and smaller joints.[13] When the trade in New Zealand mutton developed in the eighties, carcasses averaging 80 pounds were in favor. By 1892 the most acceptable weight at Smithfield market was 55 to 60 pounds. Before the war it had dropped to 48 to 56 pounds. The former popular demand for mutton has turned to lamb, which gives smaller joints.[14] This general tendency exists also in the case of beef. The demand for fat meats comes from a limited section of the population which is prepared to pay well. The great bulk of the consumers want meat from young animals of medium fatness and weight rather

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[12] K. J. J. Mackenzie, *Cattle and the Future of Beef Production in England*, pp. 2-8.

[13] *Proceedings before the Royal Commission on the Importation of Store Cattle*, 1921, p. 405.

[14] Critchell and Raymond, *A History of the Frozen Meat Trade*, p. 205.

than from the heavy fat stock which ranks so high at the live-stock exhibitions.[15]

DOMESTIC SUPPLIES OF MEAT

The most remarkable thing about the meat supplies of the United Kingdom is that, in spite of the great industrial development of the country, so large a proportion is produced at home. Britain is generally thought of as predominantly given to manufacturing and commerce with a large population in a small geographical area. This generally conceived picture portrays truth, but not the whole truth. The remarkable fact is that, for all her development of factories and trading centers, Britain's greatest single occupation is agriculture. Out of a total annual net productivity of all her economic activities amounting to £856,000,000 before the war, agriculture—including animal husbandry—produced £170,000,000 and employed about one-quarter of all the people "gainfully employed." The nearest competitor was the general category of "iron, steel and metal trades, engineering and shipbuilding" which had a net output of £153,000,000.[16] In this net productivity of agriculture, the animal industries hold a very high place. It has been estimated by a prominent authority that the value of all cattle products sold off the farms amounts to 38 per cent of the total value of all farm products, and over 31 per cent of the farmers' capital is invested in cattle alone.[17] In the years just before the war the value of the live-stock products marketed annually, even after deducting the cost of imported feed-

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[15] James Long, "A Comparison between the Fat Stock and the Carcasses Exhibited at Smithfield Show," *Journal of the Board of Agriculture* (Eng.), Vol. 21, p. 1.

[16] Oxford Survey of British Empire, Vol. I, *The British Isles*, p. 221.

[17] *Proceedings before the Royal Commission on the Importation of Store Cattle*, 1919 (Cd. 1541), p. 404.

ing stuffs, amounted to about £125,000,000, while the value of the two chief crops sold, wheat and potatoes, amounted to only about £27,000,000.[18] On the other hand in the normal days just before the war, the farms of Britain supplied approximately 60 per cent of her large requirements of meats.

The real foundation of this animal industry was laid, as we have seen, by Robert Bakewell in the latter half of the eighteenth century. As a pioneer in the breeding art he laid the foundation for a meat-producing industry which employs animals of high efficiency as producers of meat.

England, in the days of Queen Elizabeth, exported animal produce in the shape of wool from a primitive type of sheep. Beginning about 1765 a little grain was imported. The Napoleonic wars, however, stimulated more and better agriculture and, in spite of an increased population, it was not until well on into the nineteenth century that this nation lost her virtually self-supporting position as regards food.[19] The first half of the last century is famous in the history of British agriculture for the agitation over the corn laws involving a struggle between those who wanted cheap food as a basis for the expansion of industry and those who wished to save the home production of grain. In 1849, with the final repeal of the corn laws, the doom of the hope for keeping Britain self-supporting in the supply of bread grains was sealed. For a time the increase of population was greater than the increase of food due to imports. Eventually, much of the wheat production was gradually abandoned and millions of acres of land were laid down to pasture or allowed to return to a state of nature. Grain could be imported fairly

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[18] Middleton, *Food Productoin in War*, p. 28.

[19] *Report of the Agricultural Policy Sub-Committee of the Reconstruction Committee* (1920), pp. 7 *ff*.

readily with the indifferent means of transportation then in use. The British farmer then turned his attention to the raising of more and better live stock. Meat was too perishable for successful shipping from long distances. The supply of domestic meat increased, but was surpassed by the demand, and prices rose until the seventies. The third quarter of the century was the golden age of British live-stock production.[20] In the seventies, with their high prices, a dark cloud appeared on the horizon; meat from America came to England under artificial refrigeration. Driven from grain cultivation to meat production by the cheap products of free virgin soils, the British farmer saw this his last hope threatened.[21]

While the inauguration of the import trade in refrigerated meat was threatening dire consequences to the British farmers, two other movements were developing in a favorable direction. The import of grain lowered the cost of meat production and this imported feed and the new artificial fertilizers gave a fresh supply of plant food to the soil. Until 1765, England in normal years was an exporter of grain. Between that date and 1792 her status as a grain importer or exporter depended upon the weather. After 1792 she was definitely in the market for imports, but did not receive them in sufficient quantity to cheapen feed or affect the fertility of the soil until about the middle of the nineteenth century. In the case of direct fertilizer, the first cargo of guano arrived in 1835, but it was not until the middle of the century that it was imported in appreciable quantities. Nitrate of soda was gradually coming into use at the same time. Liebig's suggestion in 1840 for the chemical treatment of bones, and the manufacture of superphosphate of lime in 1843 by Lawes helped the movement along. In 1850 the refuse

[20] R. H. Prothero, *English Farming, Past and Present,* pp. 371-373.
[21] Macdonald, *Food from the Far West,* 1878, pp. 8-16.

from the slaughterhouses of London was utilized as a fertilizer.[22] The British farmer had developed the fertility of his soil hitherto practically without help from the outside, and it must be conceded that he had secured wonderful results. In the second half of the last century the importation of fertilizer in the form of feed and artificial manures did much to assist in the production of fodder as well as products for direct human consumption, and the raw material for the animal industries was considerably cheapened.

It is very interesting to note that in 1878 a Scotch agricultural expert, James Macdonald, in reviewing for the *Scotsman* the perils facing the farmers of that period from the importation of meat, told his fellow countrymen that the part of the domestic industry producing a high-class article would be free from any harmful effect from overseas supplies but that the inferior domestic product would be subjected to a destructive competition.[23] How true his prophecy was is evident after nearly half a century. The number of cattle in the United Kingdom continued to expand, passing the ten million mark in the early eighties when meat was beginning to come in under mechanical refrigeration, and passing the eleven million mark in 1891 at the time when the imports were assuming large proportions. During the war the number of cattle rose to as high as 12,453,626. In 1924, the number of cattle was estimated at 11,988,537 head. The numbers of sheep, on the other hand, have not increased. They declined during the decade of the eighties, only to increase to a new high level in 1892 when the imports were coming ahead most rapidly, but from that time until 1922 their number has decreased in the United Kingdom, as indeed it did in all the older countries. Some increase has ap-

[22] Prothero, *op. cit.*, pp. 261, 264, 272, 366-367.
[23] Macdonald, *op. cit.*, pp. 290-306.

peared since 1922, the number reported for 1924 being 25,366,673. The number of pigs fell to the lowest figure of 2,863,488 in 1880, since when it increased to over four million in 1890 and hovered around that figure until the outbreak of the war. In 1924, when the figures for both sections of Ireland are included, the number of pigs was 4,504,758.[24]

The price of meat, excepting pork, was generally downward throughout this early period of expanding foreign supplies. The lowest point was reached in 1896, from which year the general movement was upward for a time.[25] Prices of beef were weak until 1914, the year 1911 seeing the lowest figure for the average import price found by dividing the import values by quantities in the Board of Trade figures.[26] Pork prices during all this period were subject to fluctuations, but seem not to have been markedly affected by the general trend. In all this may be seen the interplay of three major factors: the rapidly increasing demand for meat with the growth of the industrial population, the invasion of the market by foreign supplies produced under cheaper conditions, and the increase in the amount of home-produced supplies in the face of both the competition of the imports and the increasing attraction for labor in the cities. Cattle and hogs increased in numbers. Owing to the introduction of better methods into animal husbandry, the productivity per animal of each class of stock was considerably increased and the total home-grown supply of each class of meat moved in a general upward direction until the war. The British live-

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[24] Critchell and Raymond, *op. cit.*, p. 423; *International Yearbook of Agricultural Statistics*, 1924-25, pp. 200-212.

[25] *Minutes of Evidence Taken before the Departmental Committee on Combinations in the Meat Trade* (Cd. 4661), Appendix II, Tables 4 and 5.

[26] McFall, *Livestock and Animal Products Statistics*, 1909-19, Dominion Bureau of Statistics (Can.), p. 119.

stock industry was on too firm a foundation to be overturned by the storms of that strenuous period.

PRODUCTION CONDITIONS

Any discussion of the meat production of the United Kingdom should take cognizance of the fact that the country as a whole is naturally better suited to the livestock industry than to the raising of grain. Sir Daniel Hall clearly expresses the influence of climatic factors in a few sentences:

> Ireland, the greater part of Scotland, and the west of England possess a distinctly oceanic climate characterized by high humidity and no great range of temperature. The east of England and the east midlands partake to some extent of the continental climate, with lower rainfall, cold winters, and comparatively high temperatures in summer. Roughly, it may be said that the continental type of climate is more suited to arable farming, the oceanic to grazing.[27]

The rainfall of this "oceanic climate" limits the growth of cereals not only through an excessive annual precipitation, but through its prevalence at harvest time and during the time for preparing the ground for sowing. The very fact of the distribution of the rainfall throughout the whole year, coupled with a comparatively uniform temperature, makes the pastures particularly productive. It is far from impossible to raise grain outside of the east. History has proved that it can be ripened on a much wider area than at the present, although more or less is now grown in all parts excepting the highlands. Only in these latter regions is grain growing impossible and grazing the only feasible type of farming, but the climatic influence throughout the greater part of the country, exclusive of

[27] Oxford Survey of British Empire, Vol. I, *The British Isles*, p. 149.

the east, is considerably more favorable to grazing than to the cultivation of cereal crops.

Nature thus gave natural facilities for developing that type of agricultural activity into which the earlier competition of outside food supplies drove the British farmers. A third factor operated in the same direction: there was a natural tendency to turn toward that type of agricultural activity which would give the greatest money return per unit of labor. Doubtless the system of land tenure, in which the actual owners derived a certain social prestige from their ownership, assisted in minimizing the importance of the element of land rental in determining what type of farming should prevail. On many of the large estates, where the landlord provides the buildings and improvements with the land, it has been the common situation that the rental paid does not equal a commercial interest on the landlord's capital investment in improvements aside from the land itself. In such circumstances the tendency is not to select the type of farming which will give the most profit per acre, but the type which will give the most profit for each person employed. Strange to say, in a small country with a large population, the limiting factor in farming has not been land, but labor. An abundance of land and a reasonable amount of capital is available for the demand.[28]

This tendency to select a type of farming producing the most profit per unit of labor was one of the strong reasons for giving up arable farming and turning to grazing. It was the same economic situation that usually prevails in frontier conditions where labor is scarce and land plentiful. By a strange vagary of economic development, parts of agricultural England were thrown back into a status partially comparable to that of a frontier country;

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[28] A. D. Hall, *Agriculture after the War*, pp. 21, 22, 26, 36.

only in England the labor that was present was highly skilled in the art of animal husbandry and the animals employed were of the highest grade known in any land. Perchance the real reason for this throwback to extensive agriculture was that the farmer had no hope of a speculative profit from an increase in the value of his land. The result was a strange combination of a type of agricultural development approaching that found in a new country with a skill of labor and quality of capital goods equal to the best in the world. Animals, highly efficient by breed as meat producers, with a minimum of highly skilled attendant labor, solved the economic problem of the majority of the farmers of Britain; that is, for those for whom it was solved.

In England and Wales the area under the plow reached its maximum of 13,839,369 acres in 1872; by 1914 it had fallen to 10,306,467 acres—a loss of 3,532,902 acres or 26 per cent. This process of turning arable land into pasture went on unequally in different parts of the country. The arable farming was better maintained in the eastern parts of England and Scotland, where the rainfall is relatively light, and in other sections of the country, as in Shropshire, where the soil is comparatively light. In some parts of the east, such as Essex, where heavy soils predominate, much arable land was also converted into permanent pasture.[29] In Scotland the situation was not so extreme as in England; the maximum acreage of arable land occurred in 1888, since which year there was a steady, but slow, decline until the war. The real change which occurred in Scotland is not so readily evident as in England. From 1874 to 1914 England gave up both grain and temporary grass for permanent pasture. The rigors of the Scotch climate make it necessary to renew much of

[29] Hall, *loc. cit.*

their grass frequently. Hence, Scotland in this period increased its temporary grass as well as its permanent pasture. This temporary grassland belongs to the arable land which yields two crops of grain in either four or five years, depending upon the crop rotation followed. In Ireland the amount of arable land has also decreased, but the proportion of permanent grass was already so high in 1874 that it also declined in the succeeding forty years, while the temporary grass increased as it did in Scotland.[30] During the war nearly three million acres of land were restored to cultivation in the Kingdom, but since peace has returned, the area of arable land has declined to the low level of 1914. Unfortunately, much of the land lost from the "arable" classification in this most recent movement has not been seeded down to pasture. Some of it has gone for industrial and residential purposes, but much has reverted to a state of nature and is now classed as "rough grazing land."

Out of 30,592,087 acres of "cultivated" land in Great Britain, 20,453,060 acres were in grass in 1924, and, in addition, 14,619,000 acres of mountain and heath land were available for grazing.[31] The quality of the permanent grass varies within wide limits. Some of it is simply land that has reverted to its natural unimproved state.[32] Much of the grass, on the other hand, has been carefully seeded down and left in good grazing condition. The best land, on which cattle are grass fattened, is naturally well watered, possesses the best of texture and is cared for very skillfully. It demands a much higher rent than good plowland.[33] Sir Thomas Middleton writes regarding the

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[30] Middleton, *Food Production in War*, pp. 17, 22, 101.
[31] *Statesman's Year-Book*, 1925, pp. 50, 51.
[32] *Report of Agricultural Policy Sub-Committee*, pp. 10, 11.
[33] Mackenzie, *Cattle and the Future of Beef Production in England*, pp. 23-25.

variation in productiveness of grassland that "the weight of meat produced by our finest pastures may be ten to fifteen times greater than by the worst, and the nourishing value of the meat produced on rich pastures may be forty times greater than that of the lean and watery meat formed on an equal area of semi-derelict grass land.[34]

The net result produced by this movement, in parts outside of the comparatively dry arable belt, is the tendency toward large farms and a small population per acre engaged in agriculture. Only 15.8 per cent of the land in England and Wales before the war was in holdings of less than 50 acres each, while 24.7 per cent was in holdings of 300 acres and more, 53.7 per cent in holdings of 150 acres or more and 68.2 per cent in holdings of 100 acres or more. Only 5.8 persons were found for each 100 acres of cultivated land.[35] Such a labor situation does not belong to truly intensive agriculture. The really remarkable thing is that farm labor has been scarce. At the present time England has a very serious unemployment situation. There never seems to have been a serious shortage of labor in Britain and the emigration has been extensive. To say that the shortage of agricultural labor is wholly due to the competitive employment furnished by the factories is entirely too sweeping a generalization to be true. To the extent to which any generalization fits the case, that made by Sir Daniel Hall does. He says: "The amount of land is still in excess of the demand for it on the part of men who are capable of using it to advantage. Owing to the attractions of other industries or to the difficulty of access to the land, the number of really skillful farmers has not been recruited rapidly enough to

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[34] Middleton, *Food Production in War*, p. 77.

[35] Middleton, *Recent Development of German Agriculture*, pp. 12, 16.

maintain the standard, still less to ensure progress."[36] Another cause for the scarcity of men trained for agriculture might have been added: the attraction of those agriculturally minded to new lands where profits could be made from increasing land values and from robbing the natural properties of the soil as well as from true agriculture.

There can be no question but that in the last quarter of the nineteenth century agriculture was usually very unprofitable. Many men were driven out of it and many remained only on account of their dogged perseverance in their old way of life. At the beginning of this century this had changed and even arable farming was again quite profitable. Nevertheless, agriculture had acquired a bad name. Men who were out of it hesitated to go in and men who were in hesitated to expand their operations and pay proper wages to induce good workmen to stay on the farms. There was no confidence in the permanence of the prosperity.[37] No certain conclusions can be drawn from the highly artificial conditions during the war, nor can we be certain that the postwar agricultural depression will be of long duration. Settled financial conditions should restore to agriculture a fair share of prosperity.

It must not be supposed that all of the British agriculture and animal husbandry lacks in intensity of operation. Britain has much very high-grade intensive agriculture and most of this intensive agriculture includes animal husbandry as one of the most important factors. The very rich fattening pastures must be classed as an intensive industry. So too must many of the arable farms so common on the east of Great Britain on which cattle and sheep are fattened largely on roots, straw and oil cake. In these portions of British agriculture the land is used

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[36] Hall, *op. cit.*, p. 36.

[37] *Ibid.*, pp. 25, 26, 43.

very intensively, although it must also be said that the size of such farms is frequently very large.[38] With the fruit and market garden farms as such we are not particularly interested.

The intensive farming which involves fattening of stock on arable land is found chiefly in the east of England and Scotland. In the eastern counties of Scotland, the highest development of arable farming combined with animal husbandry may be found. The culmination of the beef-fattening industry is found in Aberdeenshire, where turnips, straw and oil cake form the basis of the feeding ration. All through the "finishing" districts of the northeast of England and the east of Scotland "roots" are a part of the farming rotation. For many years the turnip has been an important factor in British agriculture. The northern climate not only favors the growth of these roots but gives them a high content of fattening properties. In this intensive farming system it is generally denied that cattle are kept for the profit in their fattening alone. The profit comes in that they readily turn the roots and straw into a salable product and turn back to the soil indispensable fertilizer. The roots are a very valuable factor in the crop rotation, for their cultivation destroys the weeds which otherwise would be injurious. The imported feed used by the animals is largely oil cake, containing a high percentage of nitrogen, which in turn produces a very valuable fertilizer. In the same crop rotation will be included one or two crops of temporary grass, which may be partly clover. This grass also goes to the cattle, yielding a cash return from the beef and a fertilizer return to the land. A certain amount of real addition to the plant food in the soil is thus added in newly fixed nitrogen and the humus is increased by the plowed-in roots

[38] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 58-60.

and products consumed by the stock. Along with the rotation is grown one or more crops of grain, the straw of which is eaten or tramped into the fertilizer by the stock and the grain itself largely sold. In all this the farmers can expect no profit from any single group of operations, such as the grain production or the meat production, if attempted alone.[39] In the combination, however, there was a good profit before the war.[40] The necessity for maintenance of live stock in such a type of farming for the sake of the resulting fertility is recognized by farmers and most scientific agriculturists alike.[41]

Another type of intensive animal husbandry in Britain is that of raising pedigreed stock. The export trade in these animals is so extensive and British breeds of live stock are so important in all parts of the New World that the idea sometimes gains currency that this fancy stock business is the most important part of the British live-stock industry. There can be no question of its real importance and it has, doubtless, given color to the whole animal husbandry of the country. On the whole this influence must be good, for the whole farming population must absorb some zeal for a higher quality of animals from the example of the fanciers and this industry has a tremendous biological influence upon the whole animal population of the country. On the other hand, the uneconomical standards of the export trade are said to have detracted from the highest meat-producing attainments.[42] It is a mistake, however, to assume that this industry is particularly im-

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[39] *Proceedings before the Royal Commission on the Importation of Store Cattle,* pp. 21-33.

[40] Hall, *op. cit.*

[41] Prothero, in *Proceedings before the Royal Commission on the Importation of Store Cattle,* pp. 11, 510; Esslemont (leading Scotch farmer), *ibid.,* p. 62; Hall, *ibid.,* pp. 21, 22; Middleton, *Food Production in War,* p. 31.

[42] Mackenzie, *op. cit.,* pp. 69-86.

portant as compared with raising animals for the direct production of meat and milk. The net production of Britain in pedigreed animals is her export. Naturally, a large number of such animals is sold for domestic use, but this is no more a net product from the live-stock industry than is the sale of a store bullock from the highlands to be fattened on the turnips of Aberdeen. The average annual value of the export of pedigreed cattle, sheep and hogs in a recent decade was only £437,561. This is a trivial sum as compared to the £125,000,000 realized from the sale of market stock and animal products. So also is the average annual export of 3,414 cattle as compared to the annual slaughter of 2,461,500 cattle and 981,000 calves. The export of pedigreed sheep and pigs is also comparatively small, averaging only 4,181 and 7,915 head a year respectively.[43]

The relation of meat production to dairying is not, as a rule, so close in the United Kingdom as it is on the Continent. In Britain a large portion of the beef is produced independently of the dairy industry and pigs are relatively unimportant. There is no particular connection between sheep raising and dairying. On the Continent, on the other hand, the beef produced is largely a by-product of the dairy industry and a flourishing pig production is based upon the skim milk as a by-product from butter production. Even sheep are used there to a certain extent for the production of milk.[44]

The beef-producing industry of the United Kingdom is so famous that the dairying is apt to be overlooked. Contrary to commonly held ideas, the dairy industry is more important than that of beef production even when veal is added. The value of all cattle and calves sold for

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[43] *Proceedings before the Royal Commission on the Importation of Store Cattle,* Appendix, pp. xix, xlvii.

[44] Mackenzie, *op. cit.,* pp. 1-8.

slaughter in 1914 was £27,264,000 while the value of dairy products was £29,893,000.

It is difficult to appraise the contribution of the dairy industry to the meat-producing industry. Middleton estimates that the dairy herd uses up one-quarter of its feed in making meat.[45] This contribution comes in the carcasses of the cows and bulls after their years of usefulness are passed, in veal and in young cattle started on the road for beef production. To a certain extent also the pig industry is dependent upon the dairy industry. It is impossible to generalize as to this relation. In the dairy district of Scotland the calves are usually slaughtered as veal and the carcasses of the discarded cows are not of very high quality, 25 per cent of them being infected with tuberculosis on slaughter.[46] In some sections the calves from the dairy are sold for raising into beef animals. In other and better sections, such as Oxford County, good dual-purpose Shorthorns are kept and most farmers keep cattle for both dairying and beef.[47] In England the dairy herds are mainly maintained for fluid milk. In such cases, as also in the cheese-making districts, the young stock are not generally raised on the dairy farm. In Ireland, on the other hand, and in Wales, excepting in the south, the cows are usually kept for a combination of butter making and calf rearing.[48]

THE CATTLE INDUSTRY

The annual slaughter of cattle and calves in the United Kingdom averages 2,461,500 and 981,000 respectively. It is estimated that nearly one half of the cattle are fattened

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[45] Middleton, *Food Production in War*, p. 72.
[46] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 195, 561.
[47] John Orr, *Agriculture in Oxfordshire*, pp. 218-223.
[48] Middleton, *Food Production in War*, pp. 30-31.

by their original owners and one half, or possibly 1,500,000 are sold as "stores" to be fattened in the east of England or Scotland, as a rule, on the rich pastures in summer or on turnips in the winter.[49] Roughly speaking, the producers of beef in the United Kingdom may be divided into three classes: the breeders who produce the calves; those who raise "store" cattle from the calf stage until they are ready for finishing; and those who finally fatten the animals. All of these different functions may be performed by one farmer. It has already been pointed out that nearly one half the cattle are finished by their original owners. The larger part, however, pass from hand to hand throughout their short lives and it is not uncommon for an animal to pass through several hands before it finally reaches the fattening pasture or farm.[50] As a rule, the cattle which appear in this store trade originate in the poorer districts and on the farms of the small holders. The intermediate period of their existence may be passed on the larger farms of the better quality, frequently high lying, and the fattening stage is accomplished on the best farms.

Ireland, with only 10 per cent of the human population of the United Kingdom and about 22 per cent of the feeding crops, had 43 per cent of the cattle as enumerated in the month of June, 1920. Needless to say, Ireland does not fatten nearly all the cattle she raises. Many of the farms of Ireland are too small for conducting this business. Farmers of a ratable valuation of less than £50 a year are the great raisers of cattle. These small holders raise calves and feed them up to the age of one year and then pass them on to those who attend to the intermediate or store stage. The custom has been for the southern and western counties to be relied upon for these yearlings which would

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[49] *Proceedings before the Royal Commission on the Importation of Store Cattle*, p. 116.

[50] Mackenzie, *op. cit.*, p. 9.

then be fed as stores on the larger farms in the better districts of Ireland. This custom appears to be changing gradually into one of each district developing the stock into a higher stage and the better sections producing a larger proportion of their calves. Ireland has been the great source of store cattle for the Scotch and English feeders. She also has been producing an increasing proportion of fat cattle for export to Great Britain.[51] War conditions, which allowed half-finished cattle to be classed as fat, and the later troubles of Ireland from revolution and from cattle disease have obscured this tendency which seems, nevertheless, to be fairly strong. In 1914, which was about a normal year, Ireland shipped 403,477 stores and 455,817 cattle classed as fat to Great Britain.[52] The age of these stores was from two and one half to three and one half years.[53]

On the island of Great Britain the store cattle which are sold off of the original farms for fattening come chiefly from the upland districts of England and the Highlands of Scotland. Here again the breeders are largely the small holders, including the crofters of Scotland. In England and Wales, while the small holders have but about 15 per cent of the area, they hold 29 per cent of the total breeding herd and 63 per cent of that part of the breeding herd kept on what is predominantly pasture land.[54] In Scotland it is held to be unprofitable to raise calves on the highly-rented farms of the east coast and the breeding and raising of store stock is largely confined to the lower-rented lands, such as portions of the southern uplands, the glens of the Highlands and the land of such an elevation that grain and potato crops are unprofitable.

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[51] *Proceedings before the Royal Commission on the Importation of Store Cattle,* pp. 69-73, 81, 87, 90, 105, 424, 593.
[52] *Ibid.,* p. xxiv.
[53] *Ibid.,* p. 95.
[54] *Ibid.,* p. 43.

The crofters of the west coast and the islands raise some young stock, but the cattle of the Highland breed do not make very good stores.[55] Very frequently the young cattle from these various origins pass through many hands before they finally reach a condition suitable for slaughtering. In many cases they are even started on their wanderings before they are weaned.[56]

Before 1896 a considerable number of cattle was imported from North America and purchased as stores by the feeders of the east coast. After considerable trouble with epidemics of cattle diseases it was decided to stop this trade and after 1896 all foreign animals landing in the United Kingdom were slaughtered at the ports.[57] A great deal of discussion of the question arose in the latter years of the war and in 1922 the embargo was removed in respect to the importation of store cattle from Canada, it being admitted by British authorities that the cattle from that country were exceptionally free from disease.[58]

The specialized cattle-fattening industry of the United Kingdom originated one hundred and fifty years ago in Norfolk County. The farmers of that county discovered how to grow and use the turnip as a valuable winter feed. With the economic development of the country, the Norfolk system of farming spread gradually northward. Within fifty years it was general in Northumberland and the Lothians; a few years later it reached as far north as Aberdeen and Moray; by the middle of the nineteenth century the whole east coast, from Norfolk to the northern shores of the Moray Firth, was eagerly engaged in growing turnips and preparing fat stock for the Scotch and English markets. A few other districts are similarly

[55] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 22-24.

[56] Mackenzie, *op. cit.*, p. 9.

[57] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 2-5.

[58] *Ibid.*, p. 511.

engaged, but the east coast is the great fattening region.[59] This winter feeding of cattle produces a prime beef known largely as "Norfolk" if it comes from an English farm and "Scotch" if it comes from Scotland.[60]

SHEEP HUSBANDRY

One of the noteworthy characteristics of British animal husbandry is the number of sheep. The pre-war sheep population was about thirty million, having fallen from the high point of 33,642,808 head in 1892. During and since the war the numbers fell off very much more rapidly. Within this last year or so there has been some slight recovery and the statistics for 1924 showed 25,366,673 head in Great Britain and all Ireland. Considering the area of the United Kingdom, such numbers are extremely large. Only 38,361,000 were reported in the United States in 1924 and only 6,094,000 in Germany in 1823.[61] In England and Wales 63.7 sheep were found to every 100 acres of cultivated land in 1914 and only 7 in Germany.[62]

England carries the major portion of the sheep of the United Kingdom.[63] In point of view of numbers per unit of area of cultivated land, however, Scotland greatly surpasses England, and Wales makes a close second to the former. Ireland carries about the same gross number as Wales, but has only about one-sixth as many in ratio to the cultivated land as Scotland and less than one-half as many as England.[64] The high rank of

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[59] Wilson, "'Stores' *vs.* 'Beef,'" in *Journal of the Department of Agriculture and Technical Instruction for Ireland,* Vol. 6, p. 261.

[60] Mackenzie, *op. cit.*, p. 35.

[61] *Agriculture Yearbook,* 1923, pp. 1031, 1033.

[62] Middleton, *Recent Developments in German Agriculture,* p. 15.

[63] *Agriculture Statistics,* Ministry of Agriculture and Fisheries, England and Wales.

[64] Middleton, *Food Production in War,* p. 27.

Scotland and Wales is due to the large amount of the hill land in proportion to the area of cultivated land rather than to the density of the sheep population. The rough grazings of Wales maintain a larger sheep stock per unit of area than those of Scotland on account of the poor grazing in the Scotch Highlands. The sheep of the latter country, however, are larger in size than those of the former, although in each of these countries they are smaller than in England.[65]

In England the sheep are almost as abundant on the arable land as on the pastures.[66] They are part of both intensive and extensive farming. On the lighter arable soils they are more important in maintaining fertility and utilizing the root crops than even the cattle. For this reason they are very abundant in the eastern and southern counties of England and to a small extent in other sections of the Kingdom.[67] To a certain extent at least these sheep have been raised in the mountainous districts and fattened later on the lowlands as the cattle are.[68] They are frequently "folded" on the turnip lands where they are confined by movable fences called "hurdles." The decline of arable farming in England is one of the reasons for the falling off in the sheep population, although the relatively large amount of labor required in their care and the breaking up of some of the larger holdings are also cited as reasons for their decreasing popularity.[69]

While the sheep population was declining before the war, the average production of mutton and lamb was well maintained. This was due to the changes in methods of raising these animals for market. They are slaughtered at

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[65] *Ibid.*, p. 32.
[66] Hall, in Oxford Survey, Vol. 1, *The British Isles*, p. 155.
[67] Middleton, *Food Production in War*, pp. 31, 32.
[68] *Proceedings before the Royal Commission on the Importation of Store Cattle*, p. 396.
[69] *Ibid.*, p. 520.

a much earlier age to-day and, consequently, the rate of turnover per thousand head is greater. Not only so, but an animal slaughtered to-day at twelve months yields as much meat as one of eighteen to twenty-one months old in the latter part of the last century.[70]

Middleton estimates that out of a normal production of about 290,000 tons of mutton and lamb, 40,000 tons was due to concentrated feeds, 30,000 tons to the produce of mountain grazings and 220,000 tons to cultivated crops. Of this latter, 150,000 tons are ascribed to grass and hay and 70,000 tons to roots, vetches, etc.[71]

PORK PRODUCTION

Pig raising is relatively unimportant in the United Kingdom. Those that are raised give lean meat rather than the fat pork of the American Corn Belt. Only 92 pigs are carried in England and Wales on the area of cultivated land that carried 266 before the war in Germany. In spite of the fame of the pig in Ireland and the beef of England, Ireland has fewer pigs and more cattle per unit of cultivated area than has England, whereas the pig is particularly unimportant in the agriculture of Scotland. Pigs are usually kept by the small holders, even the holdings of less than one acre taking a part in the industry.[72] They are often kept by cottagers and farm laborers as a side line.[73] Farmers who produce milk for butter making usually keep pigs to help consume the skim milk.[74] Pigs are also kept on farms of moderate size in connection with the production of store cattle.[75]

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[70] *Proceedings before the Royal Commission on the Importation of Store Cattle*, p. 396.

[71] Middleton, *Food Production in War*, pp. 68-70.

[72] *Ibid.*, pp. 27, 32.

[73] *Journal of the Board of Agriculture*, England, Vol. 22, p. 244.

[74] Orr, *Agriculture in Oxfordshire*, p. 229.

[75] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 106, 110, 111.

Poultry are found with pigs in the same farming system. The former produce about one-tenth as much meat as the pigs. Their egg production is estimated to amount to nearly three times their meat in terms of calories [76] and they, in company with rabbits and game, are charged with about one-third as much concentrated feed as the pigs.[77]

HIGH STANDARDS OF EFFICIENCY IN THE LIVE-STOCK INDUSTRY

There can be no question but that the live-stock industry of the United Kingdom is developed to a high plane. In competition with the supplies of meat from the New World the industry has maintained itself by efficiency and quality of production. The farmers of Britain have followed the advice given by Macdonald nearly half a century ago when their market was first invaded by the new supplies.[78] However, the efficiency has not been one of producing the most food per acre but that of producing the most profit per man employed in production. In order to compete with the cheap foreign supplies it has been necessary to cater to the best-paying market rather than to raise the most food. Quality, not quantity, has been the goal; and the goal has been largely attained.

Within this past generation the standards of efficiency have undoubtedly increased. The tendency toward marketing animals at an earlier age is one tendency in the right direction. This tendency is marked in the case of both cattle and sheep.[79] When it is shown that a steer slaughtered at two years of age consumes only about two-thirds as much feed per unit of human food produced as does a three-year-old, the effect upon food production of

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[76] Wood, *The National Food Supply in Peace and War*, p. 4.
[77] Middleton, *Food Production in War*, p. 37.
[78] See p. 162, *supra*.
[79] *Proceedings before the Royal Commission on the Importation of Store Cattle*, pp. 396, 405.

earlier slaughtering is evident. It also is evident that the many cattle still sent to the block from three years old and upward are not efficient as food producers.[80] The cattle industry of Britain seems to suffer from too little feeding of the cattle in the younger period of their existence and too much feeding in the finishing process. Many of the stores as they are being raised are kept growing too slowly. This is true in England [81] as well as in Ireland.[82] Many of the fat cattle, on the other hand, are made too fat, being kept on fattening rations an unprofitably long time. The wastefulness is probably greater in food production than in pecuniary profit. There is evidence that it is wasteful even in the matter of profit; it certainly is wasteful of fodder. The changing demands of the market are tending to correct these wastes. In time they will be greatly lessened. Strange to say, the argument used by the farmers against changing to more rapid development of the animals is that of soil fertility.[83] How much influence this factor has on the situation and how much is due to the social inertia which retards all progress is hard to determine.

POSSIBILITIES OF INCREASED PRODUCTION

It is frequently urged that the government should see to it that a larger share of the national food is supplied at home. During the war governmental measures succeeded in changing farming practices very radically in spite of the shortage of labor. The post-war agricultural depression is discouraging the farmers. Various schemes for governmental interference are proposed [84] but appar-

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[80] *Proceedings before the Royal Commission on the Importation of Store Cattle*, p. 95.

[81] Mackenzie, *op. cit.*, pp. 9-22, 42-55.

[82] Wilson, "'Stores' *vs.* 'Beef,'" *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. 6, pp. 261-269.

[83] Mackenzie, *op. cit.*, pp. 34-41.

[84] Hall, *Agriculture after the War, etc.*

ently the state attitude will return to substantially that of before the war: laissez faire in the main, with education in the foreground and some assistance to the breeding clubs.

If Middleton's suggestion of doubling the productivity of the pastures could be accomplished, Britain could go far toward supplying her own demands for meat.[85] It is not likely that this will be accomplished in the near future, but it is interesting to note that this one feasible change alone would make it possible for Britain, the world's greatest importer, to produce the largest part of her beef and mutton. Since grassland is used for fattening as well as raising the young stock in Britain, such an increase should be theoretically possible without any increased importation of feed.

DEPENDENCE UPON IMPORTED FEED

Part of the meat produced in the United Kingdom to-day is, of course, due to imported feed. The Food (War) Committee of the Royal Society[86] failed to make any calculation for this in estimating the proportion of Britain's food which was home-grown. All of this meat in a sense was produced at home; it was grown there, and as food it was made available there for human consumption partially from feeds, such as oil cake, which are not available for man's nourishment. On the other hand, if the supply of imported feeds were cut off, part of this food would be cut off. Middleton points out, however, that, in calculating the proportion of meat due to this imported feed, it is not fair to argue on the basis of the loss which would result from a failure of this supply, but on the

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[85] Middleton, *Food Production in War*, pp. 330, 331.

[86] Committee of the Royal Society, *The Food Supply of the United Kingdom* (Cd. 8421), 1917.

proportion which this feed takes in the total feed of the animals.[87]

The following table shows his estimates of the varieties, sources and uses of concentrated feeds in the pre-war period.[88]

ESTIMATED CONSUMPTION IN THOUSANDS OF TONS OF FEEDING STUFFS BY LIVE STOCK IN THE UNITED KINGDOM. AVERAGE OF YEARS 1909-1913.

(*In Thousands of Tons*)

Feeding Stuff	Home Produce	Foreign Produce	Total
Wheat	300	100	400
Barley	290	640	930
Oats	2,400	900	3,300
Maize and maize products	....	1,675	1,675
Rye, beans, peas, buckwheat	265	185	450
Linseed-oil cake	....	300	300
Decorticated cotton-seed cake	....	80	80
Undecorticated cotton-seed cake	....	645	645
Other oil-cakes	....	245	245
Wheat offals	250	1,195	1,445
Rice meal	....	160	160
Brewers' and distillers' grains, malt culms	335	135	470
Molasses and molasses' foods	....	95	95
TOTAL	3,840	6,355	10,195

Estimated consumption in terms of starch by:

Cattle and sheep	2,700
Horses (farm horses consume about half the total)	2,300
Pigs	1,160
Poultry, game, rabbits	365

Professor Wood estimates a dry weight of 5,200,000 tons of root crops and 55,700,000 tons of grass, hay and

[87] Middleton, *Food Production in War*, pp. 68-70.
[88] *Ibid.*, p. 37.

straw in addition to these concentrates.[89] In terms of dry weight of all feed it is evident that the total imported feed amounts to only a little more than 9 per cent. The imported feed, of course, has more nourishment per ton than the rough fodders. However, it also has more residual value as fertilizer. The surprising thing is that so small a part of the imported feeds belongs to the protein-concentrate class which is so valuable for the resulting fertilizer. No evidence is available to show the proportion of the various concentrates consumed by the different classes of stock. The oil cakes and other protein-concentrates go largely to the fattening of stock.

The results of Middleton's calculations show that about 13 per cent of the home-grown beef and mutton and 53 per cent of the home-grown pork is based upon imported feeding-stuffs.[90]

IMPORTED SUPPLIES OF MEAT

The real dependence of Britain upon the outside for meat is, of course, in the form of the finished meat itself. Prior to the war about 42 per cent of the total consumption was imported either in the form of the finished product or as live animals slaughtered at the ports.[91] In 1923 and 1924 such foreign supplies amounted to 52 per cent.[92] Prior to 1896 and again since 1922 an additional import of meat in the form of live beasts for further fattening must be considered.

This latter trade was fairly important at one time. Store cattle came in from the Continent and later from the United States and Canada. At length, in 1896, the trade

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[89] Wood, *The National Food Supply in Peace and War*, p. 19.
[90] Middleton, *Food Production in War*, pp. 87-88.
[91] *Agricultural Statistics* (1919), Part III, p. 84.
[92] *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries, 1925, p. 58.

was entirely abolished until 1922. Between those dates all cattle imported were for immediate slaughter. The fact that the imposition of the import restrictions brought about no decrease in the total number of cattle imported indicates that this store trade had only a limited importance, statistically speaking. The returns of the Board of Trade on imports show that more cattle entered in 1897 than in any previous year, with but one exception, since 1880. The store trade is now restored from Canada and its amount depends, at least to a large extent, upon the tariff regulations of the United States, which at the present time impose a heavy duty upon the natural flow of Canadian feeder cattle to the fattening fields of the American Corn Belt.

The dependence of the United Kingdom upon the outside world for meat supplies has increased irregularly but progressively since the war disturbed economic conditions. Before the war, from 57 to 60 per cent of all meat came from the home farms, the increase in home supplies keeping pace with the increase in total supplies. The proportion of home supplies was the greatest in the case of beef, which ranged from 60 to 67 per cent, but foreign supplies of beef were increasing faster than domestic. Of the mutton and lamb 50 to 63 per cent was also home produce. Here again the home supplies, while maintained in absolute quantity, were not keeping pace with the imported supplies, the total supplies of beef, mutton and lamb tending to increase throughout the period. On the other hand, home-grown pig meat just about held its own in quantity, but increased proportionately, since the imports were declining. During the war, however, the domestic production of all meats declined and the post-war recovery has not yet brought up the output even to its former levels. Meanwhile, the imports of all meat, including pork, have been particularly heavy. In 1923 and 1924 the domestic

meat supplies were only 48 per cent of the total consumption.[93] To what extent this depression in the meat production is temporary it is as yet impossible to determine. All economic life, and agriculture in particular, is still in a state of partial depression on account of conditions growing out of the war.

The extent of the use of imported meats in various parts of the United Kingdom varies greatly. As a rule the imported products go to the large commercial centers and the home stocks are eaten in the smaller places. London is said to take 40 per cent of the imported meat exclusive of pork, and Manchester, Birmingham, Liverpool and Glasgow the bulk of the rest. In 1893 only 44.4 per cent of the meat at Smithfield, the great London wholesale meat market, was imported. By 1914 it had risen to 67.2 per cent. In 1924 it was described as 82.8 per cent. Manchester uses about three times as much imported as domestic meat. On the other hand, in Glasgow and Edinburgh imported supplies take a minor position. In Dundee only 20 per cent is imported and in Newcastle only 10 per cent. Outside of the largest cities the meat supplies are mainly domestic.

The following table shows the extent of the dependence of the Island of Great Britain alone upon the outside world including Ireland.[94] Ireland, of course, produces a surplus of animals and meat which is shipped to Great Britain. This surplus appears in both cattle and pigs and their meats; the former are generally shipped alive and the latter dressed. The recent classification of the Irish supplies as imports increases the apparent dependence of Great Britain upon outside supplies.

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[93] *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries, 1925, p. 58.

[94] *Agricultural Statistics*, Ministry of Agriculture and Fisheries, 1924, Part III, p. 106.

ESTIMATED SUPPLY OF MEAT IN GREAT BRITAIN

(In Thousands of Tons)

MEATS	HOME PRODUCED *	NET IMPORTS †	TOTAL	PERCENTAGE OF MEAT SUPPLY	
				Home Produced	Imported
Beef and Veal					
Ave. 1909-10 to 1913-14	617	559	1,176	52	48
1920-21 " "	490	673	1,163	42	58
1921-22 " "	488	649	1,137	43	57
1922-23 " "	548	741	1,289	43	57
1923-24 " "	565	725	1,290	44	56
Mutton and Lamb					
Ave. 1909-10 to 1913-14	274	285	559	49	51
1920-21 " "	171	326	497	34	66
1921-22 " "	204	341	545	37	63
1922-23 " "	185	355	540	34	66
1923-24 " "	184	269	453	41	59
Pig Meat					
Ave. 1909-10 to 1913-14	258	339	597	43	57
1920-21 " "	197	357	554	36	64
1921-22 " "	288	395	683	42	58
1922-23 " "	221	474	695	32	68
1923-24 " "	274	535	809	34	66

* These figures include stock imported from Ireland and Canada as stores and fattened in Great Britain. In the case of cattle this represents about 25 per cent of the total home production.

† These figures include imports of tinned or canned goods, including tongues, etc., and also imports of fat stock from Ireland and abroad.

CHAPTER VII

THE CONTINENT OF EUROPE

Twentieth-century Europe presents one of the greatest markets for meat. The rapid expansion of the population of this continent in the past century, consequent upon its industrialization, has made its demand for this product outgrow the supply. Whether or not this is a temporary situation is a matter subject to question. At least for the present the meat demands of this region draw supplies from other countries both in the form of imported live and dressed meat and in the form of feeds for the animals on its own farms. Western Europe, including Great Britain, is distinctly a deficiency region to-day in the matter of the meat supply, and as such it is the one great market for the international trade in both animal foodstuffs and feeds.

Western Europe is distinctly the original habitat of the meat-producing industry as the modern world knows it. The pastoral life of Asia is not to be compared to the animal husbandry of the more dominant civilization. The methods of the leading live-stock producers of the world belong to the civilization of Europe. The herds of live stock most widely used to-day were developed in western Europe, chiefly in Great Britain. And the methods of marketing meat in use to-day have grown up in the European civilization as it is at home and as it has expanded into the New World. The use of a large proportion of meat in the diet is distinctly a habit of the peoples originating in western Europe.

A complete description of the meat industry of Europe

would cover all the phases of this side of economic life which have yet developed, except for the peculiar modification of frontier conditions which appears in new lands. Economically speaking, the sheep industry of England in the days of Queen Elizabeth was comparable to the sheep industry of the early American west and that of South Africa to-day. England at that time was really a pioneer country with a surplus of agricultural resources which she exported to industrial Flanders in the shape of raw wool. The means of transportation then in existence in western Europe made it necessary to ship the produce of the fields in this nonperishable, easily transportable form. It also was more profitable to adopt extensive grazing than to develop real agriculture. Both these conditions have existed in the frontier everywhere as it has shifted to the American west, to South America, Australia and South Africa. By a strange vagary of economic development it has even touched again on some of the country regions of England.

Between that stage of the frontier live-stock industry and the bullock-fattening farms of Aberdeenshire, the veal production of the Netherlands and the bacon industry of Denmark, western Europe has seen every stage of the development of animal husbandry which has yet appeared. Its nations have passed through the various stages from that of a real or easily possible surplus of animal products to that which, in general, rules to-day: a deficiency region depending upon other countries for part of its meat, either in the form of the finished product or the feed as raw material for its own live stock. Western Europe now knows better than other lands how animal husbandry fits into true agriculture. The live-stock industry is increasingly an integral part of true agriculture as distinguished from the grazing of animals on natural pasture. In some cases it is not only a part of a relatively high agricultural development, but even approximates the economic status

of the industries of the factories, buying its raw materials from other lands, using as little as possible of the earth's surface and turning out a finished manufactured product. Those sections which present this degree of development do produce a surplus for shipment into other parts of this general area.

Eastern Europe, on the other hand, is distinctly backward as yet in all branches of the farm life. Its animal industry, as well as all rural affairs, is based upon prejudice and custom rather than upon a more or less distant following of the teachings of science. Nevertheless eastern Europe, which is not industrialized and depends largely upon agriculture for a livelihood, tends less to produce a surplus of meat for the urban districts than do the highly developed sections of the west where there is a dense human population. The agrarian revolution, which followed the war, is doing much to change conditions in the animal industries, but it will be many years before they will reach the point of efficiency now held by the industry in western Europe.

France

France is a leading industrial nation. Industry, however, has not been developed at the expense of agriculture and in the years immediately preceding the war the country produced about 90 per cent of its total food requirements, including nearly all of its meats.[1]

CONSUMPTION

The consumption of meat is fairly heavy. Estimates for 1862 show a per capita consumption of 57.1 pounds.[2]

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[1] Commission Scientifique Interalliée du Ravitaillement, *Annexes au premier rapport*, pp. 11, 12, 39.

[2] M. Massé, in *Bulletin des Halles*, Sept., 22, 1923.

Before the war it was variously estimated at 89.9 pounds to 125.6 pounds per capita.[3] After a decrease during the war, the use of meat has increased to more than pre-war amounts. Unofficial estimates place the recent average consumption at about 115 pounds a year for each person including 59.8 pounds of beef and veal, 9.2 pounds of mutton and lamb and 46 pounds of pork.[4] In addition there is a considerable consumption of horse meat as well as of poultry.

In the half century before the war the meat consumption increased quite markedly. J. E. Lucas, in a report for the Association Nationale d'Expansion Économique, advances very telling arguments in support of his conclusion that the average annual consumption was 110.87 pounds just before the war.[5] H. de Lapparent in his *Élevage des bêtes bovines,* published in 1913, gives substantial evidence showing that the production of beef and veal had more than doubled in the preceding fifty years.[6] In the absence of material exports, the consumption must also have been doubled. In the same time the numbers of pigs on farms had increased more rapidly than the cattle, and sheep have never played any large part in French meat consumption. It is impossible to escape the conclusion that the average per capita consumption of meats in general was approximately doubled in the half century before the disturbance of war. This increased use of meat during the period of rapid industrialization is very noteworthy, especially in view of the fact that it

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[3] R. F. R. Martin, *Meat Marketing in France,* Report to Bureau of Agricultural Economics, U. S. Department of Agriculture and *Foreign Crops and Markets,* U. S. Department of Agriculture, April 13, 1925, pp. 409, 410.

[4] *Foreign Crops and Markets,* U. S. Department of Agriculture, April 13, 1923, p. 409.

[5] J. E. Lucas, *Le Marche de la viande en France* (1917).

[6] H. de Lapparent, *Élevage des bêtes bovines* (1913), pp. 4-6.

was practically all supplied from the domestic flocks and herds. This increase of consumption also paralleled an increase in the price of meats as compared with the price level of wheat.[7]

The last two years of the war witnessed a decrease in the average consumption of meat in spite of large importations and a rate of use in the army that was higher than had been known in civil life. The official estimate of the total meat consumption before the war was 3,530,225,900 pounds, of which only 20,716,626 pounds were imported. In 1916 the consumption rose to 3,617,631,756 pounds, of which 572,494,937 were imported. In 1917 the consumption had declined to 3,265,012,600 pounds, of which 561,-467,528 pounds were imported. In 1918 the imports were only 396,828,000 pounds and the total consumption was 3,012,186,867 pounds.[8]

During the past few years meat consumption has increased fairly rapidly. Peasants and laborers who served in the army became accustomed to an unusually good meat ration and are not disposed to give it up after returning to civilian life. Both farmers and laborers are said to be better off financially now, than before the war, and can afford more meat. The introduction of frozen meats during the war to a great extent broke down the prejudice against this class of imported meats, which now finds a material place in consumption. In Paris the total consumption of beef, mutton and lamb rose from 290,108,000 pounds in 1918 to 336,802,000 pounds in 1919, which was slightly higher than the pre-war record.[9] The consumption of pork in Paris also recovered rapidly immediately after

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[7] *Foreign Crops and Markets,* U. S. Department of Agriculture, June 15, 1925, pp. 701, 703.

[8] Commission Scientifique Interalliée du Ravitaillement, *Deuxième rapport,* p. 25.

[9] *Foreign Crops and Markets,* U. S. Department of Agriculture, May 9, 1923, p. 328.

the war.[10] This postwar tendency toward increase has proceeded with no material setbacks and promises to continue for some time at least.[11] It must be remembered that increased total consumption in France means almost entirely an enlarged per capita use, for the population is increasing but slowly.

Beef, veal and pork are the chief meats consumed in France, although mutton and lamb are used to a certain extent and goat meat and horseflesh as well as poultry appear in the diet in limited quantity. As a consumer of beef the Frenchman ranks with the German, being below the standard of the Englishman in the quantity and probably the quality of his beef.[12] The following table shows the relative importance of the chief meats in the Parisian's diet before the war.[13]

ANIMALS SLAUGHTERED AT VILLETTE MARKET, PARIS, 1921

Animals	Numbers	Dressed Weight per Carcass in Pounds	Total Weight of Meat in Pounds
Cattle	205,606	723.1	148,673,699
Calves	239,155	134.5	32,166,347
Sheep and lambs.....	1,134,129	41.9	47,520,005
Goats	657	44.1	28,974
Swine	318,491	152.1	484,424,811

The French want their meat comparatively lean. The very fat beef which is popular in Britain and the United States is not demanded. Many consumers prefer to buy very lean meat and separate supplies of fat in which to cook it. Comparatively light carcasses are also most

[10] *Foreign Crops and Markets*, U. S. Department of Agriculture, July 25, 1923, p. 87.
[11] *Ibid.*, April 13, 1925, pp. 409, 410.
[12] Mackenzie, *Cattle*, pp. 1-8.
[13] *Revue générale du froid*, February, 1923, pp. 60, 61.

popular. To bring the best prices beef should not weigh more than about 160 pounds per quarter. The quality in demand also is not what is held in highest esteem in England. While the French use a type of beef that would not to be accounted the best in English-speaking countries, their veal is quite superior. The veal comes from milk-fed calves, the slightest tinge of red in the meat disqualifying it for veal.[14]

The rate of consumption of pork is slightly less than that in the United Kingdom and very much below that of either Germany or the United States. The type of pork produced is also in distinct contrast to that of the American corn-fed hog. The French hog is a lean bacon type rather than a lard producer. In spite of the demand for a comparatively lean pig, there is a strong demand for lard, which is imported heavily from the United States. There is also a considerable demand for sausage. Smoked meats are not used materially in the south, although efforts are being made by American interests to popularize them there. In the north they are in favor. Lard is also used more extensively in the north where olive oil is not so popular.[15] Pork is used largely as fresh meat, considerable quantities being imported even in that form or frozen.

THE DEVELOPMENT OF THE LIVE-STOCK INDUSTRY

Some light is shed on the development of the French live-stock industry by the following table giving the numbers of animals throughout the past eighty-five years.[16]

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[14] *Foreign Crops and Markets*, U. S. Department of Agriculture, April 13, 1925, pp. 409, 410.

[15] *U. S. Commerce Reports*, April 24, 1922, p. 213.

[16] *Foreign Crops and Markets*, U. S. Department of Agriculture, April 13, 1925, p. 410; *Annuaire international de statistique agricole*, 1925-26, pp. 220-232.

LIVE STOCK IN FRANCE

Year	Cattle	Sheep	Swine
1840.....	11,762,000	32,151,000	4,911,000
1852.....	11,971,000	33,282,000	5,246,000
1862.....	12,812,000	29,530,000	6,038,000
1883.....	11,794,000	21,640,000	5,847,000
1888.....	13,377,000	22,631,000	5,847,000
1893.....	12,155,000	20,276,000	5,861,000
1898.....	13,419,000	21,278,000	6,231,000
1903.....	14,105,000	17,954,000	7,561,000
1908.....	14,240,000	17,456,000	7,202,000
1913.....	14,788,000	16,131,000	7,036,000
1919.....	12,374,000	8,991,000	4,081,000
1920.....	13,217,000	9,406,000	4,941,000
1921.....	13,343,000	9,600,000	5,166,000
1922.....	13,576,000	9,782,000	5,196,000
1923.....	13,749,000	9,925,000	5,406,000
1924.....	14,025,000	10,172,000	5,802,000
1925.....	14,373,000	10,537,000	5,793,000

It is evident that there was no striking increase in live stock of any class throughout the period under review. The numbers of cattle and swine increased gradually up to about the first decade of the century. Strange to say, the number of swine appeared to be declining somewhat just before the war, although there was a considerable increase up to the year 1903. The numbers of sheep decreased almost continuously throughout the whole period until after the war, but particularly rapidly during the war.

Part of the loss during the war was supposed to have been due to appropriation by the Germans in invaded districts. It has been estimated that, outside of losses occasioned by actual military operations, the Germans accounted for about 803,215 cattle, 540,521 sheep and 327,-865 swine. It was generally assumed early in the war that such losses were greater, but recent critics suggest that even these figures are too large and it is freely admitted that a material part of the actual reduction in the numbers

of animals in the early days of the war was caused by mismanagement on the part of the French authorities. Animals were sent to Paris and other concentration points in a haphazard manner with little provision for their care while alive or their meat after slaughter. Great numbers were so wasted.[17] Lack of feed was another cause of decline. In the pre-war years the average feed supply amounted to 97,615,533 million calories. In 1916-17 this had decreased to 81,242,402 million. In 1917-18 only 73,782,584 million and in 1918-19 only 70,647,232 million calories were available.[18] Naturally the numbers as well as the productivity of the live stock decreased.

Since reconstruction has begun, the flocks and herds have increased again. The sheep have not nearly recovered their pre-war status; nor are they likely to do so, for the trend was downward in any event. The numbers of cattle, however, are officially admitted to be about as great as previously and the popular idea is that only political reasons connected with the reparations question have left the official estimates as low as they are. The figures for recent years, of course, include the stock of Alsace-Lorraine. The cattle returned by the Germans as reparations-in-kind, not belonging to the breeds desired in France, have been used largely for slaughter. However, the availability of these German animals for slaughter has to a certain extent permitted a greater increase of the native stock.

Statistics showing the change in the animal population throughout a long series of years are wholly inadequate to show the trends of meat production. Data are available for France which give unquestionable proof of this

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[17] M. G. Wery, in Commission Scientifique Interalliée du Ravitaillement, *Deuxième rapport*, pp. 40-45.

[18] Commission Scientifique Interalliée du Ravitaillement, *Deuxième rapport*, pp. 28-31.

fact for that country and render it easy to suppose that similar data are just as inadequate as an index of meat production in many other countries. Unfortunately, data on actual meat production are not available for many countries for a long series of years, nor are they for all classes of meats in France. For the meat production of the cattle, however, excellent data are available in the work of M. de Lapparent already noted. In the fifty years leading up to the war, the increase in the numbers of all cattle was fairly small and such increase as did take place came chiefly in the number of cows, the numbers of beeves or oxen actually decreasing. Nevertheless, the increased productivity per animal and rate of turnover was so great that the amount of beef and veal produced increased by about 100 per cent in the half century. Better methods of animal husbandry were developed, the herds improved so that the slaughtering weight was greater and the age of slaughter was lowered so that the proportion of the total animal population slaughtered each year was greatly increased. It is said that the general marketing age for cattle has been about cut in half. As already noted, the beef from cows holds a large place in the meat production. In the period 1882-1909 the increase in the number of cows and their increased weight have added 639,334,000 pounds to the weight of this class of animals available each year. The number of work oxen actually decreased by about 180,000 head during this period. The weight per animal and the slaughtering age have been improved so much, however, that the meat from this class of animals has increased very greatly. It is estimated, moreover, that in this time the number of steers slaughtered without ever having served at the yoke increased from 150,000 to 300,000 head. The live weight for annual slaughter for all oxen and steers has been expanded by 396,828,000 pounds. An appreciable number

of heifers is also slaughtered for meat.[19] It is evident that the beef-producing industry is gradually losing its dependence upon the use of cattle for farm work and is not by any means completely dependent upon the dairy industry.

This improvement in the productivity of the live stock has accompanied a general tendency to develop animal husbandry at the expense of the production of cereal and leguminous crops. The total cultivated land has been shrinking before a steady expansion of lands put down in permanent grass. Meanwhile root and annual forage crops have been taking a larger share in the lands which were cultivated. This shift from other branches of agriculture to animal husbandry has accompanied the increased ratio of beef to wheat prices to which reference has already been made.[20]

BEEF PRODUCTION

During the past few decades there has been some development of the production of what corresponds to the American "baby beef." For nearly four decades France has regularly and systematically raised a limited number of this class of beef animal. The Limousin and Charolais breeds are the most important for this industry. The district of Nevers sends young pasture-fed bulls and heifers to Lyons and Paris. The largest go to the latter market and the smaller animals to Lyons. They weigh 1,000 to 1,540 pounds at not more than two years old. Young Limousin cattle butchered at eight to sixteen months of age have a gross weight of from 550 to 990 pounds. The fattening of such cattle is confined to a few sections.[21]

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[19] De Lapparent, *op. cit.*

[20] *Foreign Crops and Markets,* U. S. Department of Agriculture, June 15, 1925, pp. 701, 703.

[21] Lapland et Dechambre in *Comptes rendus de l'Académie d'Agriculture de France,* Vol. VI, No. 33 (Paris, Nov. 10, 1920), pp. 795-798, 802-808.

Cattle are distributed fairly evenly throughout France, excepting in the south, but beef animals are found chiefly in the west and in a belt running east and west through the center of the country. The whole live-stock industry is conducted mainly in small units. Diversified farming is the rule and a few cattle and pigs are kept on most of the farms. Fattening is frequently conducted on a larger scale, especially in the northeastern part of the country. Lean cattle in lots of as large as several hundred are bought in the spring, fattened during the summer and sold in the fall. Cattle are also stall fattened during the winter.[22]

In the past cattle have been raised very largely for the production of milk and for their labor, both cows and oxen being used as work animals. It has been estimated that three-quarters of the tractive power on farms was supplied by cattle before the war. Within recent decades France has developed important breeds especially valuable as beef animals. The meat qualities of some of the native breeds have been developed, but the greatest progress has been achieved by the introduction of a certain amount of Durham blood in the best native stock. The leading type resulting from this cross is known as the Durham-Manceaux and is found chiefly in the departments of la Mayenne, Maine-et-Loire, Loire-Inférieure, la Sarthe and Ille-et-Vilaine. The better steers are sold to be fattened on the excellent finishing pastures of Calvados and Eure and the more ordinary steers are fattened on the pastures of Orne, Pas-de-Calais, Aisne and Ardennes. The surplus heifers are sold for stall fattening in Choletais. The Charolais breed holds about the same importance in central France. Certain other crosses of the Durham, some of which are dual-purpose work and beef animals, and the Limousin breed also figure very materially in the beef-

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[22] Martin, *op. cit.*

producing industry. Many of these animals are raised solely for beef and are either grass or stall fattened. Apparently these various breeds which are used largely in the beef industry comprise not less than one-quarter of the entire French herd.[23]

Veal production is also a very important part of the cattle industry, the calves being milk fattened for several months before sale. About three calves are slaughtered for every two adult cattle.

PORK PRODUCTION

Swine are well distributed all over the country. As already noted, they belong to the lean bacon type and are not heavy lard producers. Consequently, they do not require large quantities of concentrated feed. Pigs are raised in conjunction with other farming operations and act in a measure as scavengers. In the northwest where the dairy industry is most highly developed, skim milk is an important feed. In the central part of the country beet pulp and potatoes are an important feed and in the southeast considerable corn is fed. North of Marseilles oil cake figures prominently in the feed. Recently an important industry has sprung up around the large cities of fattening pigs on garbage.

THE SHEEP INDUSTRY

The sheep industry has always been based primarily on the demand for wool. The meat has been utilized, but never made a special aim. The milk of the sheep is also utilized. The sheep industry is scattered fairly well over the country, but is more important in the south. In the southern part of the Rhone Valley a special industry has been built up based upon breeding in the valley and send-

[23] De Lapparent, *op. cit.*, pp. 26-64.

ing the flocks to the mountains for grazing in the spring and summer.[24]

MARKETING OF LIVE STOCK

Due partly to the different dispersion of the various species of animals, but more largely to differences in season of maturity, there is a considerable movement of stock from one district to another for consumption. This movement is largely of live animals which are sold through various fairs and municipal markets. No packing industry, in the American sense, exists in France, very little refrigerated freight service for the domestic trade and but little refrigerated storage for meats. The regular demand for meat is met chiefly by the difference in the seasonal maturity of the animals. Paris obtains its summer and autumn beef largely from grass-fed cattle and its winter and spring beef from cattle fattened in the stalls.[25]

RELATION TO AGRICULTURE

The French scientific agriculturalists regard their live stock as a necessity not only for meat, milk and work, but for their effect upon the fertility of the soil as well. Although not used so freely as in some of the neighboring countries, chemical fertilizers are used fairly widely and are said to take a larger quantitative position than animal manure,[26] but the latter is regarded as indispensable

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[24] Martin, *op. cit.*

[25] Lucas, *op. cit.*

[26] The following estimate of supplies of fertilizers before the war is based upon data presented by M. G. Wery, to the Inter-Allied Scientific Food Commission (Second Report):

Nitrates	Animal	323,700	metric tons
	Mineral	412,500	" "
Phosphates	Animal	149,400	" "
	Superphosphate	1,800,000	" "
	Basic Slag	375,000	" "
Potash	Animal	373,500	" "
	Mineral	90,000	" "

especially on account of its effect upon the physical properties of the soil.[27]

The following table, taken from a report of the Inter-Allied Scientific Food Commission, shows the feed supply of the live stock of France in normal pre-war days. It is impossible to distinguish the needs for meat production from that of milk or work production. It is not very fruitful for our purposes even to calculate the proportion used for horses, since oxen and even cows are used for working, and horseflesh is used for human food. It has been calculated, however, that of 6,640,865 metric tons of concentrated feeds consumed before the war 4,091,373 tons went to cattle and sheep and 2,549,492 tons to pigs.[28] One of the most noteworthy matters in these statistics is the heavy consumption of beet root. Another fact worth noting is that oil cake is the leading feed among the imports.

The Commission showed the amount of the imports in metric tons and the nutritive value of each class of feed in starch equivalents. It is a simple matter from these data to compute what proportion of the feed, in terms of starch equivalents, was imported. This appears as 5.07 per cent of the total. Following Middleton's reasoning, in his *Food Production in War,* we may conclude that 5.07 per cent of the productivity of the animals was based upon foreign supplies and 94.93 per cent on home-raised feed. The post-war developments in the importation of feed indicate no very striking changes in this relation of local food production to the output of the farms in the outside world.[29]

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[27] Commission Scientifique Interalliée du Ravitaillement, *Deuxième rapport,* pp. 8-9.

[28] *Ibid.,* p. 19.

[29] *Foreign Crops and Markets,* U. S. Department of Agriculture, Nov. 26, 1924, p. 565.

LIVE-STOCK FOOD SUPPLY AVAILABLE, 1909-1913

Food	Domestic Production, Metric Tons	Net Importation, Metric Tons	Total (Gross Weight), Metric Tons	Total Value in Starch Equivalents
Bran and impurities:				
Of wheat	2,309,787	348,544	2,658,331	1,400,940,437
Of rye	277,000	.....	277,000	139,608,000
Various others, etc.	.....	143,543	143,543	69,044,183
Mixed grains	141,489	.....	141,489	100,881,657
Corn (maize)	562,000	341,000	903,000	735,945,000
Barley	800,000	.....	800,000	576,000,000
Rye	323,948	52,052	376,000	268,088,000
Buckwheat	409,878	.....	409,878	216,005,706
Oats	4,823,000	433,000	5,256,000	3,137,832,000
Millet, etc.	14,235	5,070	19,305	11,525,085
Residue of rice	.....	70,000	70,000	42,980,000
Dried vegetables and vetches, etc.	13,240	15,287	29,067	19,358,622
Chestnuts	100,000	.....	100,000	34,100,000
Residue from breweries and distilleries	410,000	.....	410,000	157,850,000
Oil-cakes	60,500	589,500	650,000	471,250,000
Molasses	63,052	200	63,252	30,360,000
Beet-pulp from sugar factories	3,000,000	30,000	3,030,000	321,180,000
Forage beet-roots	21,945,354	.....	21,945,354	1,382,557,302
Potatoes	5,000,000	.....	5,000,000	950,000,000
Rutabagas and turnips	2,887,279	.....	2,887,279	216,545,925
Jerusalem-artichokes	1,609,892	.....	1,609,892	264,022,288
Cabbage for fodder	7,674,176	.....	7,674,176	721,372,544
Artificial grass-lands:				
Clover hay	4,342,000	.....	4,342,000	1,346,020,000
Lucern hay	5,352,400	.....	5,352,400	1,380,919,200
Sainfoin hay	2,759,000	.....	2,759,000	858,049,000
Temporary grass-lands	980,000	.....	980,000	285,354,600
Green annual forage	14,608,540	.....	14,608,540	1,446,245,460
Natural meadow (hay)	16,888,000	.....	16,888,000	5,235,280,000
Grass (in hay)	5,124,000	.....	5,124,000	1,854,960,400
Pastures	3,829,000	.....	3,829,000	907,473,000
Straw, etc.	8,000,000	.....	8,000,000	1,120,000,000
Carob-beans	.....	20,473	20,473	14,872,731
Grape residuum	836,195	10,043	846,238	21,155,950
Apple and pear residuum	1,000,000	.....	1,000,000	95,000,000
Skim milk	1,400,000	.....	1,400,000	128,800,000
TOTAL				25,961,578,050

FOREIGN TRADE

Immediately before the war France depended to less than 1 per cent of her consumption upon imports for her meat supplies. In the case of beef and veal she was slightly more than self-supporting. A few thousand cattle and calves were imported from Algeria and the French section of Morocco, but the export of live cattle and calves to Morocco more than offset this import. The heaviest export, 35,000 cattle in 1913, went to Switzerland. Exports of dressed beef also exceeded the imports. Mutton and lamb were imported more heavily than any other meat. This import was largely in the form of live animals from Algeria and Tunis. The exports of this class of meat were small. Live hogs were imported to a certain extent from northern Africa, but exported thence still more heavily, nearly thirty thousand being exported to Morocco. Over forty thousand were imported from Holland, largely through Belgium.[30] Hog products were the largest im-imports, the greatest single item being lard from the United States, although the total lard imports were not quite equal to those of cured pork. Needless to say this foreign trade was largely seasonal, ebbing and flowing with the annual movements of domestic production. Lard imports are an exception to this rule, the French hog not being a good lard producer.

During the war and immediately thereafter, the imports of meat were heavy. The maximum import of fresh, chilled and frozen beef was 504,173,000 pounds in 1919. From then until 1922 such imports declined rapidly, being cut about in half each year up to the latter year. Since 1922 such imports have increased again.[31]

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[30] Lucas, *op. cit.*

[31] J. E. Wrenn, *International Trade in Meats and Animal Fats*, U. S. Department of Commerce, Trade Promotion Series, No. 26, p. 225.

Pork imports increased during the war, but reached their high point in 1919. After a great decrease in 1920 and 1921, imports of fresh and frozen pork have been increasing during the past few years. This category was small before the war. It now overshadows that of bacon and hams, but is surpassed by that of lard which comes largely from the United States.[32]

During the first half of the year 1925, beef and mutton were imported much more heavily than in 1924. During the last half of the year, however, the imports, particularly of pork, were so small that the total imports of all meats for the year show a small decrease from the 1924 figures. Beef and mutton imports taken together for the year as a whole were larger, the deficiency appearing in the figures for pork.[33]

During recent years a fairly important trade has sprung up in the purchase of horses from England, Spain and Luxemburg for the production of horse meat. The numbers of horses imported range from ten to thirteen thousand a year. Live cattle from the Argentine were imported as an experiment but this trade could not be said to be successful.

The war introduced refrigerated beef to the rank and file of the French population. France was the first European country to import meat under mechanical refrigeration,[34] but this trade failed until recently to receive popular support. The present indications are that these imported supplies are finding a solid position in the French market of to-day. An organized mercantile effort is being conducted to entrench this trade and the refrigerated beef is being sold at lower prices than the domestic

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[32] *Ibid.*, pp. 221-225.

[33] *Foreign Notes on Meats, Fats and Oils,* U. S. Department of Commerce, March 19, 1926, p. 9.

[34] Critchell and Raymond, *History of the Frozen Meat Trade,* p. 27.

supplies.[35] Nevertheless, the live-stock industry of France is recovering and may soon supply the needs of the population even in the face of an expanding demand for meat. The half century before the war doubled the productivity of the French beef-producing industry, but the expansion is far from its possible limits.

Spain

Spain's position in the world's meat industry is small except for the influence of her cattle and sheep breeds in so many parts of the New World. The Americas from the southern part of the United States south to the southern part of Argentina received their original herds of cattle from the Iberian Peninsula. The Merino sheep of Spain have also contributed strongly to the blood of the flocks in many lands. Within the last few years the Spanish live-stock industry has had only a national importance, not quite sufficing to supply the demands for meat in the home land.

The country is primarily agricultural and pastoral, but even for this type of life nature has not been bountiful. The central part of the peninsula is a table-land which is subject to great extremes of temperature and has only a light rainfall. The southern parts are subtropical and also not well watered. The north and northwestern seaboard districts enjoy a temperate climate and plenty of rain. It is in this latter section, particularly in the northwest, that the cattle and swine industries find their greatest development. Sheep, however, and goats, are found more abundantly on the central plateau.[36]

Several centuries ago sheep and goats were very abun-

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[35] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1922, p. 12.

[36] V. C. Finch and O. E. Baker, *Geography of the World's Agriculture*, pp. 123, 133, 139.

dant in Spain, and the cattle and swine were relatively few. In recent times the demand for wool has lost its comparative strength and the animal industry has turned its attention more toward the production of meat-producing stock. Even the sheep of Spain have lost their preëminence in wool production, the Merinoes have been allowed to lose their predominance and sheep are now raised principally with a view to their meat-producing qualities. Goats are also used largely for meat. The great decrease in the number of sheep came before the last century, during which the industry held its position.[37] From 1891 to 1912 there was an almost steady increase in the numbers of cattle, sheep and swine, but particularly of swine.[38] The war apparently stimulated all branches of the live-stock industry. As will be seen from the following table, the year 1921 saw a material increase over the pre-war stock in all classes. The increases, however, have not been completely maintained.[39]

LIVE STOCK IN CONTINENTAL SPAIN

(*Numbers in Thousands*)

Stock	1913	1921	1922	1923	1924
Cattle	2,879	3,718	3,297	3,435	3,436
Sheep	16,441	20,522	19,377	18,550	18,460
Goats	3,394	4,298	3,970	3,804	3,804
Hogs	2,710	5,152	4,229	4,728	4,160

In company with the increase in numbers of stock there has come an improvement in the raising of crops for feed. As a consequence, the animals are not wholly dependent

[37] *Agricultural Coöperation and Rural Credit in Europe,* U. S. Senate Document No. 214, 63rd Cong., pp. 626, 628.

[38] *Meat Situation in the United States,* U. S. Department of Agriculture, Report No. 109, p. 205.

[39] *International Yearbook of Agricultural Statistics,* 1924-25, pp. 200-212.

upon grazing and can be fattened more quickly. Livestock insurance and a rural police system have also made the interests of the farmers more secure.[40] The increased production of cereals was not stopped by the war. Estimates of production for recent years show a substantial improvement over pre-war figures.[41] Spain is largely self-supporting in feeding stuffs. Some corn is imported for feed.[42] The animals have the benefit of the milling offals from a small importation of bread grains. On the other hand oil cake is exported.[43]

The cattle industry of Spain by no means confines its attention to dairying. In Galicia stock breeding is the most important industry. This section is the center of an important trade in steers for the Madrid and Barcelona markets.[44] The animals are not fat in accordance with the tastes of the markets in English-speaking countries. They are usually about three years old and yield about 600 pounds of meat each. The cattle breeders are well organized, having a national association which claims to date from the time of the Moors. This association has done much educationally for the industry and is very active politically to secure tariff protection and improved marketing facilities.[45]

The Spanish pig is mostly of the native type which is thin, but the flesh is said to be very delicate. They are largely scavengers and live on mast pastures and refuse. They provide the chief meat of the rural population.[46]

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[40] *Agricultural Coöperation and Rural Credit in Europe*, p. 624.
[41] *Foreign Crops and Markets*, U. S. Department of Agriculture, Dec. 3, 1924, p. 587.
[42] *Ibid.*, p. 589.
[43] *Ibid.*, Nov. 29, 1924, p. 567.
[44] J. G. Armendaritz in *La Industria pecuaria*, Vol. XXII, No. 709, pp. 435-437.
[45] *Agricultural Coöperation and Rural Credit in Europe*, p. 625.
[46] *Foreign Crops and Markets*, U. S. Department of Agriculture, Dec. 3, 1924, p. 591.

Sheep and goats are also important meat producers. Even the goats produce an important part of the meat. The following table shows the numbers of animals slaughtered for consumption in the official abattoirs in 1920:[47]

ANIMALS SLAUGHTERED IN ABATTOIRS FOR CONSUMPTION

Stock	Number	Pounds
Cattle	1,067,000	470,603,000
Sheep	7,324,000	145,336,000
Goats	1,504,000	43,122,000
Swine	2,525,000	556,809,000
TOTAL	12,420,000	1,215,870,000

Estimates of meat consumption for the year 1923 give an average per capita consumption of 16.8 pounds of beef, 26.4 pounds of pork, 8.8 pounds of mutton and lamb, 2 pounds of goat and kid and 9 pounds of poultry and game, making a total of 63 pounds. The consumption is heaviest in the rural districts and somewhat lighter in Madrid than in the provincial towns.[48]

The foreign trade in animals and meats has not been very important, although appreciable numbers of animals and certain quantities of meats were imported before the disturbances which came with the war. Throughout the later years of the war, the imports became much less and within recent years the importation has been less than one half of the pre-war figure. In the average year before the war there was a very small net import of pork products. Since the war there has usually been a net import of these products amounting to several millions of pounds.[49] This is very noteworthy in the light of the

[47] *Foreign Crops and Markets,* U. S. Department of Agriculture, June 7, 1922, p. 287.

[48] A. W. Ferrin, *U. S. Consular Report,* Feb. 25, 1926.

[49] Wrenn, *International Trade in Meats and Animal Fats,* U. S. Department of Commerce, Trade Promotion Series No. 26, p. 301.

great increase in the numbers of native pigs. It is more difficult to import beef and mutton or lamb, for Spain has not been equipped with cold storage facilities. Nevertheless, refrigerated meat is being imported.[50] It would appear that the consumption of meats in general is increasing very materially.

Portugal

The live-stock industry of Portugal is one of the most important local interests. It provides for the meat requirements of the six million inhabitants and small net contributions for foreign trade, but has no other particular importance in the world's meat business.

The land of Portugal is a small strip on the coast west of Spain. Its eastern boundary is in the mountains which border the table-land of the latter country. Portugal is a maritime country and, in contrast with much of Spain, has a very large rainfall. Accordingly there are no extensive grazing grounds.

The cattle are raised chiefly on the lower lands, and, to a great extent, are stall fed. Numbers of good beef animals have been exported to Spain where they are fattened for slaughter.[51] Large herds of swine are fed in the oak and chestnut woods on the mountain sides, but the numbers are decreasing. Sheep and goats are raised in the mountains. With the exception of Greece, Portugal has the greatest number of goats in relation to both the number of human beings and the area of the country of any country of Europe. It also ranks comparatively high in the number of sheep. The whole business of farming is conducted on the basis of old-time methods and is, consequently, not as productive as it might be. The most recent

[50] Ferrin, *op. cit.*

[51] C. Sheppard in *Revista de medicina veterinaria* (1916), No. 168, pp. 351-360, reviewed in the *International Review of the Science and Practice of Agriculture,* 1916, p. 995.

data available show 740,693 cattle, 3,850,733 sheep, 1,492,-689 goats and 921,312 pigs.[52] There is a small international trade in live stock, consisting chiefly of exports with a smaller number of cattle appearing in the imports. The imports of meat are very small.[53]

Italy

The modern nation of Italy is still young and the economic life of the country has been reborn with the new national existence. Neither industry nor agriculture is highly developed as yet in the modern sense. The building up of modern farming activities in such an old land, however, is a problem quite unlike that of establishing a new life in an unexploited country. Old customs and methods required change instead of introducing new ideas and equipment into a virgin field. Italy has been reconstructing her economic life as rapidly as possible and the disturbances of war appear to have given only a temporary setback to her progress. So far, at least, the industrial expansion has not discouraged the development of agriculture. In spite of the dense population the country is normally almost self-supporting in the matter of food[54] and has purchased its small food deficit out of the remittances of immigrants in foreign lands rather than from a surplus industrial production. The natural advantages for agriculture are only modest, but no great abundance of natural resources or other advantage for industry gives assurance that factory production will presently be expanded at the expense of agricultural progress. Such

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[52] *Annuaire international de statistique agricole,* 1925-26, pp. 220-232.

[53] *Commerce international du bétail et de ses dérivés,* pp. 11-30.

[54] Commission Scientifique Interalliée du Ravitaillement, *Annexes au premier rapport,* p. 39.

progress must come from improvement of the existing resources, for the country is practically all utilized now, in so far as it is readily available for use. Improvements, moreover, while already well under way, are by no means fully applied in the light of the teachings of modern scientific agriculture, and Italy has ahead of it abundant opportunity for such a type of agricultural expansion. It is not so clear, however, that these improvements will increase production sufficiently to meet the needs of the rapidly increasing population.

Italy has three different types of land with entirely different possibilities for agriculture: high mountain regions, hill country and plains. The Alps in the north and the Apennines, which run through the center of the country are Italy's two high chains of mountains. On these there is a scattered population depending to a considerable degree on their live stock for a livelihood. The hilly country has decidedly greater agricultural possibilities and supports a larger population, tilling the soil largely on the share-cropping basis. In the two great plains of Lombardy and Apulia cereals are raised extensively, but the live-stock industry is by no means neglected. The country extends in a narrow peninsula northwest and southeast, and has great variations in climate throughout its length. In the north there are severe winters and ample rainfall. In the south it is dry and hot and agriculture is rather backward.[55]

The consumption of meat in Italy is only moderate in amount but it is increasing. The statistics on this question are none too exact and there is a considerable difference of opinion as to the exact amount consumed in the years before the war. The first official estimate of meat con-

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[55] *Agricultural Coöperation and Rural Credit in Europe,* U. S. Senate Document No. 214, 63rd Cong., p. 27.

sumption covers the year 1903. It showed a consumption of 46.54 pounds per capita, but this amount is considered to be an overestimate. Dr. E. Raseri later estimated that the actual consumption in that year was only 28 pounds of dressed meat.[56] In 1908, an official investigation was made of the consumption in the 346 communes with a population of over 10,000. The following domestic supplies were found:

SLAUGHTERINGS IN 346 COMMUNES IN ITALY IN 1908

Stock	Number of Animals	Dressed Weight of Meat in Pounds
Cattle	1,047,466	381,293,932
Buffaloes	3,235	1,078,179
Sheep and goats	539,329	37,588,280
Horses	28,071	9,554,154
Pigs, etc.	1,759,743	132,473,234
TOTAL	3,377,844	561,987,779

These local supplies amounted to 561,987,779 pounds. Supplies of poultry and imported meats brought the total consumption up to 664,870,453 pounds, which averaged about 56 pounds per capita in these communes. The consumption in these was higher, doubtless, than that in many other parts of the country. Nevertheless, there is very good reason to believe that the average per capita consumption for the whole country had increased from the year 1903.[57]

Professor Nello Fotticchia estimates that the total national domestic supplies available in 1914 were as follows:[58]

[56] Prof. Nello Fotticchia, "La Produzione zootechnico italiana," *Nuovi annali del Ministero per l'Agricultura*, 1922, p. 333.
[57] *Ibid.*, p. 334.
[58] *Ibid.*, p. 335.

MEAT PRODUCTION IN ITALY IN 1914

Stock	Number of Animals	Dressed Weight of Meat in Pounds
Cattle and buffaloes.	1,850,000	683,426,000
Sheep and goats	5,500,000	99,207,000
Swine	2,000,000	485,012,000
Horses	50,000	16,534,500
TOTAL	9,400,000	1,284,179,500

Disregarding the production of game, poultry, etc., and the balance between a total meat import of 7,675,756 pounds and export of 9,442,522 pounds, there results a per capita consumption of about 35 pounds in the year of the beginning of the war.

The Inter-Allied Scientific Food Commission adopted the following estimate for the average annual consumption in 1909-1913:[59]

AVERAGE ANNUAL CONSUMPTION OF MEAT IN ITALY, 1909-1913, IN POUNDS

Meat	Production	Excess of Imports (+) and Exports (—)	Total
Beef	683,426,000	+ 12,200,256	695,626,256
Mutton and lamb	99,207,000	.....	99,207,000
Pork	330,690,000	.....	330,690,000
Horse	16,534,500	.....	16,534,500
Salt and smoked	.....	— 5,628,344	— 5,628,344
Ham	.....	— 209,437	— 209,437
Lard	154,322,000	+ 7,378,796	161,700,796
Other fat	22,046,000	+ 40,890,921	62,936,921
Offals	198,414,000	.....	198,414,000
TOTAL	1,504,639,500	+ 54,632,192	1,559,271,692

[59] Commission Scientifique Interalliée du Ravitaillement, *Annexes au premier rapport*, p. 19.

This amounts to an average consumption of 45 pounds, including fats and edible offals, for each person.

During the war slaughterings for the army and navy made heavy demands upon the live stock of the country. In 1917 and 1918 more than 800,000 head of cattle were slaughtered each year for military uses alone. The relative numbers of the various classes of cattle slaughtered in 1916 and their production in terms of live weight shed considerable light on the meat-producing industry of the country.

REQUISITIONS FOR THE ITALIAN ARMY AND NAVY IN 1916

Class of Cattle	Numbers	Live Weight in Pounds
Bulls	10,853	10,400,753
Oxen	116,596	155,716,550
Fat oxen and steers	63,042	57,886,294
Heifers	54,449	45,020,559
Cows	363,958	353,335,931
TOTAL	608,898	622,359,957

In addition, tens of thousands of pigs and sheep were slaughtered for the territorial military garrisons. No exact record of these animals is available. The military forces also consumed almost all the imported fresh and refrigerated meats.[60]

Meanwhile restrictions were placed upon the consumption of the civilian population. These restrictions, however, were not very carefully enforced. The following table, showing the slaughterings for civilian consumption, is very illuminating in showing the comparative productivity of the various Italian provinces.[61]

[60] Fotticchia, *op. cit.*, pp. 340-342.
[61] *Ibid.*, pp. 343-344.

SLAUGHTERINGS OF CATTLE FOR

(Weights in Thousands

PROVINCE	UNDER ONE YEAR		OVER ONE YEAR	
	Number	Live Weight	Number	Live Weight
Piedmont	69,253	28,468	130,119	70,152
Liguria	42,809	10,433	20,621	12,666
Lombardy	83,248	22,147	32,292	18,647
Venetia	58,642	14,660	25,498	14,063
Emelia	32,254	12,009	13,559	9,515
Tuscany	66,765	40,377	51,715	39,519
Marches	9,840	4,922	4,763	2,861
Umbria	6,250	4,005	3,516	2,692
Latium	20,307	9,590	10,647	5,862
Abruzzi and Molise	6,848	2,915	3,707	2,308
Campania	32,361	16,081	16,171	9,561
Apulia	9,512	4,603	7,579	4,949
Basilicata	634	177	366	136
Calabria	7,741	3,288	3,513	2,013
Sicily	13,526	5,912	37,116	21,483
Sardinia	980	182	2,302	703
TOTAL	460,970	179,771	363,484	217,130

* These figures, furnished to the Minister of Agriculture by the

Rectifications made later show that at least 1,600,000 cattle, 1,800,000 swine, 5,000,000 sheep and 50,000 horses were slaughtered for civilian consumption in 1915.[62] It is altogether likely that the yield of meat per animal was reduced somewhat below the normal. However, when these figures are compared with those of the slaughterings in 1914 for all purposes it will appear that the civilian population consumed nearly as much in 1915 as the whole population did in 1914. The army and navy consumed the meat from 585,043 cattle and an unknown amount of other meats in addition.[63]

This rate of slaughtering was a severe tax on the live-

[62] *Ibid.*
[63] *Ibid.*, pp. 340-342.

CIVILIAN POPULATION IN ITALY IN 1915 *

of Pounds)

FULLY GROWN		SHEEP IN 1915		SWINE, OCTOBER TO MARCH, '15-'16
Number	Live Weight	Number	Live Weight	Number
44,414	38,042	179,165	6,554	107,116
60,714	48,958	166,697	6,539	22,545
95,255	82,473	87,451	4,555	218,316
70,274	73,900	123,450	7,247	282,493
63,191	73,336	259,229	10,578	284,527
33,908	35,860	438,795	10,178	105,922
3,457	2,860	143,800	4,773	99,777
4,665	5,254	138,168	5,821	55,334
39,528	43,207	193,216	6,317	108,066
4,498	4,231	390,757	9,697	90,088
36,689	30,084	529,625	14,269	195,086
14,889	15,350	603,965	18,192	27,961
983	569	158,133	3,639	34,430
7,209	6,212	349,108	9,026	53,175
22,570	16,785	394,380	11,579	40,382
19,091	12,001	475,250	11,841	39,044
521,335	489,121	4,631,489	140,810	1,764,062

communes, are admittedly below the complete slaughterings.

stock industry. During the succeeding years increasingly strong attempts were made to restrict civilian consumption. Apparently, these attempts were partially successful, for in eight months in 1919 only about 734,000 cattle were slaughtered in cities and towns for urban consumption.[64] In spite of the loss of 370,000 cattle, 100,000 swine and 110,000 sheep in the Austrian invasian of Venetia, the census of 1918 showed only moderate reductions in the meat-producing animals. It would appear that the livestock industry of Italy had reacted strongly to the increased war demands.[65]

The animal industry had been restored to its pre-war

[64] *Ibid.*, p. 348.
[65] *Ibid.*, p. 351.

LIVE-STOCK NUMBERS IN ITALY IN 1918 AND 1914

Stock	1918	1914
Horses	989,786	1,000,000
Asses	949,162	930,000
Mules	500,555	420,000
Cattle	6,239,341	6,900,000
Swine	2,338,926	2,750,000
Sheep	11,753,910	12,000,000
Goats	3,082,558	3,000,000

proportions in practically all regions by the year 1921 and the total national production was conceded to have been fully restored by that time. Animals imported as reparations were slaughtered, thus allowing the domestic herds to increase. The recent tendency seems to be distinctly toward expansion of the live-stock production, and the consumption of meats is high, especially among the social classes which have advanced most economically.[66]

An unofficial estimate gives an average per capita consumption of 48 pounds and 6 ounces for the year 1924 and 30 pounds and 13 ounces in 1913, showing an increase in the decade of over 50 per cent.[67] Assuming the same proportion of consumption shown above in the estimate of the Inter-Allied Scientific Food Commission for 1914, this would allow 26.3 pounds of beef, 3.7 pounds of mutton and lamb and 18.3 pounds of pork and lard. Part of the increased consumption in 1924 was due to the greatly enlarged imports of meat in that year, following the abolition of the import duties in June, 1923.[68] The raising of cattle has progressed constantly for years, particularly in the north, with the exception of the interrup-

[66] *Ibid.*, p. 367.
[67] R. A. Boernstein, *U. S. Consular Report*, Jan. 7, 1926.
[68] A. Hobson, *The Agricultural Survey of Europe, Italy*, U. S. Department of Agriculture, Report F. S. 35, February, 1926, p. 44.

tion due to the war. Progress in the central regions has been healthy but less impressive than in the north, while in the south conditions have improved only in some localities. A good idea of the differences in development of the industry may be gleaned from the foregoing tables showing the meat production by provinces during the war. It also is worth noting that in three of the chief northern provinces, Lombardy, Emelia and Venetia, the density of cattle was 664, 616 and 513 head respectively, per square kilometer in 1908, while in Abruzzi and Molise only 11.8, in Sicily 9.8 and in Basilicata only 9.1 head per square kilometer were counted.[69] The variation in density is due partially to the relative importance of sheep in the south.[70] The main differences in the development of the cattle industry, however, are due primarily to differences in agricultural progress, which in turn has depended largely on natural opportunities and difficulties. In 1920, the production of all forage reduced to the equivalent of hay showed an average of 3,307 pounds per square kilometer. In the north the production was 8,377 pounds in Emelia, 7,716 pounds in Lombardy and 4,409 pounds in Venetia. In central and southern Italy, in addition to the problem of the mountains, malaria and aridity present very real difficulties and the large estates stand in the way of development.[71]

In Lombardy, part of Venetia, the Piedmont, Emelia and a limited part of the islands the production of milk is the leading phase of the cattle industry. Here the raising of milk-fed calves is very important, the number of calves slaughtered being about 40 per cent of the total killings. A weight of 440 pounds is nothing unusual at the

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[69] Fotticchia, *op. cit.*, p. 367.

[70] B. Bianchini, *Revista agricola romana*, Vol. XLVII, No. 34, pp. 91-109.

[71] Fotticchia, *op. cit.*, p. 368.

time of slaughtering. In other parts of the country and to a certain extent in these regions, the triple purpose predominates: milk, meat and work. The attempt to introduce the Shorthorn as a distinct beef breed has met with little success.[72] In many regions well-developed programs had been started to improve the breeds for meat and milk without getting a degree of specialization unsuited to local conditions. These programs, interrupted by the war, are now being pushed with increased vigor.[73]

The water buffalo is a fairly important animal in central and southern Italy. As a rule the animals are kept until they are about twelve to sixteen years old when they are fattened for slaughter. The meat, though darker in color, and coarser than beef is just as wholesome.[74]

Sheep have continued to increase for years in Italy, with but a brief interruption during the war.[75] These animals are more valuable in Italy for their milk than for either wool or meat. Their flesh, however, has already been shown to be important. On the Campagna Romana the best pastures are reserved for the sheep while the cattle and other stock are relegated to stubble fields and arid pastures regarded as too poor for the sheep. It is chiefly along the central and southern Apennines and in the islands that the sheep are most important. In those regions there is a large industry in raising migratory flocks of sheep which are pastured on the lowlands in the winter and on the highlands of the mountains in the summer. The flocks of sheep belong to shepherds who rent their pasturage both on the plains and in the mountains. A similar

[72] V. Alpe, "La vacca da latte nell' agricultura italiana," *L'Italia agricola*, An. LIX, pp. 281-284.

[73] Fotticchia, *op. cit.*, p. 362.

[74] Bianchini, *op. cit.*, Vol. XLVII, pp. 120-128.

[75] G. K. Holmes, *Meat Situation in the United States*, Report No. 109, U. S. Department of Agriculture, 1916; V. Vezzani, "L'allevamento della pecora in Italia," *Minerva agraria*, Year XI, Nos. 5-6, pp. 49-52.

industry centers in the summer grazing on the highlands in the Alps. Sheep are also raised on the smaller farms of Italy where they are kept as scavengers.[76] Recent attempts to improve the Italian breeds by the introduction of English breeding stock have not been successful.[77]

Pig raising is important in Italy and the industry has been growing during recent years. There are three different systems in the industry. In the cheese-making districts it is founded on the residue from the cheese. Many of the large breeds of pigs are also raised in the oak groves where they are allowed to forage in the open. Probably the most important part of the industry is based upon the consumption of milk, kitchen scraps and other refuse. In the south and central parts of the country and in Emelia, Yorkshire breeding stock has been introduced very freely, in some places the native breeds being completely supplanted by these crosses with the "Large Whites." Other foreign breeds, notably the "Large Blacks" and Poland China have also been introduced. These crosses seem to be very successful.[78]

The feeds consumed by the animals are almost all home grown. Corn, oats and oil seeds are the most important imports that are used for feed. The table on page 223, taken from the estimates of the Inter-Allied Scientific Food Commission,[79] shows the pre-war domestic production, foreign trade and estimated animal consumption of each class of potential feed. The proportion of the total feed which comes from the outside world is very small.

The foreign trade in meats was small before the war. The tables on pages 576-583 show the net imports and ex-

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[76] Vezzani, *loc. cit.*

[77] Fotticchia, *op. cit.*, p. 364.

[78] *Ibid.*, pp. 365-366; *International Review of the Science and Practice of Agriculture*, 1921, pp. 1002-1004.

[79] Commission Scientifique Interalliée du Revitaillement, *Deuxième rapport*, p. 35.

ports in the average pre-war year. The following table shows the total imports and exports in the year 1914.[80]

IMPORTS AND EXPORTS OF ANIMALS, MEATS AND FAT IN ITALY IN 1914

PRODUCT	IMPORTS		EXPORTS	
	Quantity	Value in Lire	Quantity	Value in Lire
Cattle	29,875	10,163,560	26,842	15,975,610
Sheep	1,337	33,425	33,979	849,475
Goats	866	21,650	330	8,250
Swine	50,362	3,726,398	11,804	1,932,238
Meat, fresh	7,304,062	4,306,250	1,918,791	1,566,360
Ham	50,715	57,500	662,382	841,120
Bacon	4,201,407	2,267,560	257,764	187,040
Sausage	321,489	335,340	6,855,565	7,772,750
Poultry	2,409,844	2,098,380	12,415,473	11,662,200
Meat extract	621,810	758,350	.....	.....
TOTAL	14,991,867	23,768,413	22,182,930	40,795,043

The imports of the ordinary meats and of the live animals exceeded the exports in quantity in normal pre-war times. However, when the trade in poultry and sausage is taken into account and the greater relative value per unit of the exported products, the exports exceed the imports. The total value of the exports was 40,795,043 lire while the imports were only 23,010,063 lire. When dairy and other animals and poultry products are included in the totals the value of the exports also exceed that of the imports. Moreover, the exports of animal products were increasing all along the line, before the war disturbed conditions. The trade in meats and animals was largely with the neighboring countries.[81]

During the war there were large imports of both beef and pork products.[82] In the years following the war this

[80] Fotticchia, *op. cit.*, pp. 338-339.
[81] Bianchini, *loc. cit.*
[82] *Commerce international du bétail et ses dérivés*, pp. 20-31.

ANIMAL FEEDING STUFFS USED IN ITALY, 1909-1913 *

Metric Tons

Products	Production Less Quantity Used for Seed	Excess of Imports (Exports —) Waste Deducted	Total Disposable	Quantities Actually Consumed by Animals
Wheat	4,392,900	1,536,738	5,929,638	.....
Maize (corn)	2,429,609	364,716	2,794,325	838,290
Rice	294,500	— 58,892	235,608	.....
Oats	483,200	117,153	600,355	600,355
Rye	119,185	15,543	134,728	13,472
Barley	195,890	17,622	213,512	106,756
Wheat offals	1,482,500	.....	1,422,500	1,482,500
Corn offals	335,316	.....	335,316	335,316
Rye offals	42,439	.....	42,439	42,439
Barley offals	14,495	.....	14,495	14,495
Husks of rice	14,535	.....	14,535	14,535
Wheat straw	8,607,000	.....	8,607,000	2,382,100
Rice straw	427,000	.....	427,000	128,000
Oat straw	858,000	.....	858,000	257,400
Rye straw	270,000	.....	270,000	81,000
Barley straw	319,000	.....	319,000	95,700
Leaves and corn stalks	4,487,000	.....	4,487,000	1,346,100
Linseed	8,900	42,453	50,453	.....
Seeds of field cabbage and of rape	.....	4,578	4,578	.....
Seeds of sesame and of peanut	.....	32,077	32,077	.....
Linseed cakes	29,464	.....	29,464	29,464
Field cabbage and rape cakes	2,929	.....	2,929	2,929
Sesame and peanut cakes	19,245	.....	19,245	19,245
Cocoanuts	.....	47	47	.....
Cocoanut cakes	37	.....	37	37
Mown hay	24,232,400	— 34,082	24,198,318	24,198,318
Potatoes	1,481,292	— 91,166	1,390,126	347,531
Chestnuts	642,900	— 27,320	615,580	123,116
Carob-beans, broad beans, kidney beans	685,530	12,770	698,300	384,085
Residue from sugar refineries, breweries	.....	.....	.....	449,650
Grape skins	.....	.....	.....	250,000
Skim milk	.....	.....	.....	50,000

* Commission Scientifique Interalliée du Ravitaillement, *Deuxième rapport*, p. 35.

trade declined for a time, but in 1924 it reached large proportions, the imports of frozen meat alone amounting to 280,000,000 pounds.[83] The imports of lard and other pork products amounted to about 34,000,000 pounds in the first nine months of the year.[84] The future of Italy's foreign trade in meats is problematical. It would appear that, as yet at least, the domestic supplies have merely been restored to pre-war levels, and have not kept pace with the growth and increasing demands of the population. Every effort, however, is being made to increase the home production.

Switzerland

Switzerland, although a mountainous country, has about three-quarters of its area devoted to productive uses, including forests. Approximately three-quarters of the productive area is natural meadow and pasture. Two chains of mountains cross the country, the Alps and the Jura. In the space between these ranges is found a fertile region of hills and lesser mountains ranging from four to six hundred meters above sea level. The temperate climate and abundant rains favor the production of forage and nearly all of the suitable land on the lower mountains and on the country between them is utilized for agricultural and live-stock production. The land devoted directly or indirectly to live stock is estimated to be about 70 per cent of the total used in agriculture.[85]

The following table shows the numbers of meat-producing animals before and after the war.[86]

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[83] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1924, p. 11.

[84] *Foreign Crops and Markets*, March 4, 1925, p. 265.

[85] *Agricultural Coöperation and Rural Credit in Europe*, U. S. Senate Document No. 214, 63rd Cong., 1st Session, p. 471.

[86] *Foreign Crops and Markets*, U. S. Department of Agriculture, June 21, 1922, p. 313.

LIVE STOCK IN SWITZERLAND

Stock	1911	1921
Cattle	1,433,000	1,425,000
Pigs	570,000	639,000
Sheep	161,000	244,000
Goats	341,000	329,000

The cattle are utilized primarily for dairying, but the meat-producing capacity of the stock is not neglected and the quality as well as the quantity of production is good.[87] The cattle industry is centered in the pasture lands. The animals remain in the open air from spring to well on in the autumn. In the summer they are pastured on the highlands, while early and late in the season they are kept on the lower levels.

The following table, giving the number of the different classes of animals slaughtered annually for several years, shows something of the comparative importance of the different classes of beef and veal production. The relative decrease of dairy stock slaughtered and the increase of oxen or steers are interesting.[88]

LIVE STOCK SLAUGHTERED IN SWITZERLAND

Year	Bulls	Oxen	Cows	Heifers	Calves	Sheep	Pigs
1917	29,111	15,826	128,030	59,051	322,840	39,772	248,912
1918	35,393	27,498	159,120	88,529	345,557	48,100	135,934
1919	26,585	27,295	124,110	69,642	306,931	74,568	164,953
1920	27,621	31,332	94,262	51,518	295,693	74,174	235,367
1921	27,301	42,621	74,251	30,130	305,207	70,365	326,415
1922	32,832	29,345	113,735	51,134	372,193	84,223	454,497
1923	27,905	40,602	122,081	56,442	379,595	89,336	405,163

The domestic production of meat before the war was estimated to supply about 70 per cent of the country's

[87] *Agricultural Coöperation and Rural Credit in Europe*, p. 479.
[88] *Foreign Crops and Markets*, May 9, 1923, p. 331.

requirement.[89] Immediately before the war the imports were increasing rapidly. The war interrupted the growth of import trade, except for lard and edible tallow, which were imported in unusually large quantities.

The consumption of meat amounted to 297,307,258 pounds in 1915. In 1920, only 210,767,815 pounds were consumed. By 1922, the amount had risen to 281,340,143 pounds, or 75 pounds per capita.

Immediately after the war imports increased and rose to record figures in the year 1921 since when they have fallen to less than pre-war levels.[90]

Belgium

Belgium is one of the most highly industrialized nations of Europe. At the same time her animal industry is developed more intensively than that of any of her neighbors.

The prosperity of Belgian agriculture and animal industry is not based upon natural fertility of the soil. Much of the land is not endowed by nature with any particular advantages for agricultural production. The notable productivity of the fields of Flanders has been established by man's energy. Commercial fertilizer has recently aided in the enrichment of the soil, but the real work of the upbuilding of the fertility of the naturally unproductive soil was accomplished by means of careful cultivation in conjunction with an intensive animal industry.

In the early days of the development of the country Belgium was primarily an agricultural country. Feudal lords of both church and state developed an agricultural industry that laid the foundation for future farm prosperity. In the middle ages the towns developed and over-

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[89] *Commerce Reports,* April 7, 1924, p. 14.

[90] Wrenn, *International Trade in Meats and Animal Fats,* U. S. Department of Commerce, Trade Promotion Series, No. 26, p. 252.

shadowed the life of the country. The political and religious disturbances of the sixteenth century brought about the disruption of town life and the energies of the Belgians were turned to the development of rural institutions. Agriculture again became the leading economic activity of the country.[91] With the industrial revolution of the last century city life again took the lead, and agriculture has been eclipsed but not depressed as a result.

Just before the war overturned the established conditions of this little country her industrialization had resulted in a density of human population materially greater than that of any other country of Europe.[92] At the same time her animal industry, as shown by the index of the density of population of the leading meat-producing animals, was also the most highly developed in Europe—615.3 cattle and 417.4 hogs per square kilometer was the showing of Belgian animal husbandry. Against this appeared 577.5 cattle and 376 hogs in Denmark, 592.9 cattle and 368.5 hogs in Holland, 373.2 cattle and 405.4 hogs in Germany and 377.2 cattle and 135.1 hogs in the United Kingdom per similar unit of area. Aside from the 495.1 hogs per square kilometer in Luxemburg and 696 cattle per square kilometer in Gibraltar, Belgium easily led in the numbers of cattle and hogs per unit of the total national area.[93]

The industrial development of the last century has been accompanied by a material increase in the live-stock industry while production of cereals for human consumption has lost its relative importance. The area under grain for human consumption declined by 25 per cent in the last half of the last century and that under oats increased by

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[91] B. S. Rowntree, *Land and Labour, Lessons from Belgium*, p. 15.

[92] *Annuaire international de statistique*, 1916, "État de la population" (Europe).

[93] *International Yearbook of Agricultural Statistics*, 1909-21, pp. 237, 246.

23 per cent. The production per acre was increasing so rapidly that the wheat production increased slightly from 1846 to 1906 while that of oats more than doubled during that time.[94] Meanwhile the production of sugar beets was inaugurated and was assuming large proportions. Beets produced primarily for forage as well as sugar beets which yield a forage by-product are now very important crops. Meanwhile the live-stock population increased consistently until the outbreak of war and has shown remarkable recovery since peace has been established. There seems little danger in assuming that the yield of meat per thousand animals found on the farms has increased materially in Belgium as it has in the surrounding countries. Certainly the industrialization of Belgium has been accompanied by a material increase in meat production. The increase, however, as we shall see later, has not been sufficient to keep pace with the increasing demands for domestic consumption.[95]

Development of Live-Stock Industry in Belgium

Year	Horses	Cattle	Pigs	Goats	Sheep
1846.....	294,535	1,203,891	496,564	110,060	662,508
1856.....	277,311	1,257,649	458,418	.....	583,485
1866.....	283,163	1,242,445	632,301	197,138	658,097
1880.....	271,974	1,382,815	646,375	248,755	365,400
1895.....	271,527	1,420,978	1,163,133	257,669	235,722
1900.....	241,553	1,657,494	1,005,501	.....	.....
1906.....	244,893	1,779,678	1,148,083	.....	.....
1911.....	261,967	1,812,191	1,229,428	217,823	185,373
1921.....	222,055	1,514,953	975,748	.....	.....
1923.....	243,184	1,602,728	1,176,430	.....	.....
1924.....	252,314	1,627,655	1,139,073	.....	.....
1925.....	250,024	1,654,767	1,151,719	.....	.....

[94] Rowntree, *op. cit.*, pp. 174 *ff.*

[95] *Ibid.*, p. 173, for data up to 1906; data 1911 and 1921 from *Annuaire international de statistique agricole*, 1909-21, pp. 237-246. Data for 1923, 1924 and 1925 from *ibid.* for 1925-26, pp. 212-232.

Meat production in Belgium is essentially an accompaniment of the dairy industry. It would not be correct to say that meat is produced as a by-product of dairying, as it is in some intensive milk-producing regions where the only meat produced is from the carcasses of the worn-out milking stock and undeveloped calves. On the other hand, there is little or no specialized meat production separate from the dairy industry comparable to the meat-producing industries of the new countries. In Belgium meat production and dairying are mutually supporting industries; each is more efficient by reason of the development of the other.

Belgium is a small country, but within her small area has a marked variety of physical conditions under which her agriculture is conducted. The narrow strip of country along the sea is land reclaimed from the sea. This is a section of rich meadows and cattle breeding is an important industry. South of this strip is a sandy region, naturally lacking in fertility. The western part of this, the plains of Flanders, has been artificially developed into a garden spot. The eastern part, the Campine, is as yet not so well developed. In Flanders the artificial fertility of the soil is closely related to the intensive animal industry. In the Campine the live-stock industry constitutes the most important source of the farm income.[96] South of the sandy zone is a district of loamy soil possessing better natural fertility. This is a great sugar-beet area, in conjunction with which the animal industry is most important. A small district known as the Herve, in the southeastern part of this section, by reason of its altitude, soil texture and rainfall, is given over almost wholly to pasture and fruit growing. South of the loamy soil belt is a clay belt, known as the Condroz. Here again

[96] *Étude de bétail de la région Campinoise,* p. 11 (Belgian Government publication).

cattle are important and special root crops are grown extensively as fodder. South and east of the Condroz is the region of the Ardennes mountains. Agriculture here is not so highly developed as in some other regions. South of the Ardennes is a small region of lower land broken up into valleys where pastures are common.[97]

Belgian farming, as already noted, has tended within the last few decades to increase the production of feed for her live stock rather than the production of cereals for direct human consumption. While the movement toward the laying down of pasture has not been nearly so extreme as it has been in England, nevertheless, there was a marked tendency in Belgium before the war to increase the pasturage. The production of oats increased greatly in the years before the war. The sugar-beet industry was developed in the last half century and the production of beets grown solely for fodder is now still more important than the sugar-beet industry. In 1923, 4,300,231 metric tons of fodder beets were produced and 2,036,519 tons of sugar beets.[98] The pulp and tops of the latter are an important feed. In addition to the feed produced at home, Belgium imports large quantities of feed grain and oil cake. In the average year in 1910-1914, Belgium had a net importation of 17,580,000 bushels of corn, 8,358,000 bushels of oats and 15,272,000 bushels of barley. This was nearly three times the Danish importation of these coarse grains. On the other hand, the net imports of oil cake and meal were 388,275,000 pounds against a Danish import of 986,552,000 pounds.[99] Manifestly, the Belgian farmer is not so careful to purchase feed from the outside in a form of protein concentrate that will add most to the fertility of his soil.

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[97] Rowntree, *op. cit.*, pp. 3-13.

[98] *Repartition et rendement des cultures* (1923), Ministère de l'Agriculture et des Travaux Publics.

[99] *Foreign Crops and Markets,* Nov. 26, 1924, p. 565.

Since the war the importation of coarse grains has been restored almost to the pre-war rate while that of oil cake has been allowed to decline seriously. The import of wheat in the form of grain is also high and the resulting milling offals afford an important feed.[100]

The cattle and calves which are slaughtered are, as a rule, the males and other animals not desired for use for dairying in the herds of general-purpose cattle. Surplus calves, especially males, are raised for veal. Calves sold for veal are fed from seven to twelve weeks. Many of the calves are fed whole milk during this entire period and may be fed eggs in addition. Such animals will weigh 198 to 276 pounds at slaughter. Veal is not produced solely on whole milk. Many calves are raised on skim milk and grain. Not all of the calves are sold for slaughter while so young. It is not uncommon to keep them on feed until the age of ten months or a year when they will weigh 331 to 386 pounds. Cows, which through age or other reason have become unprofitable milkers, and bulls, which are usually discarded while young, are systematically fattened for slaughter. These animals were formerly fattened in the stable, but the development of pasturage has within recent years proved the basis for a certain amount of grass fattening. The raising of pigs is also an important accompaniment of the dairy industry, producing slightly more meat in 1923 than the production of beef and veal combined.[101]

Consumption of meat in Belgium is not heavy when comparisons are made with other western industrial nations. In 1923, the consumption of all meats, including about 8 pounds of fowl, was only about 88.5 pounds for each person. In 1924, the consumption, aside from fowl, amounted

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[100] *Annuaire international de statistique agricole,* 1909-21, pp. 252-283.

[101] *Étude du bétail de la Région Campinoise,* p. 11.

to 90.5 pounds.[102] The poorer classes of the population eat comparatively little meat. The following table shows the consumption of the various kinds of meat in 1923.[103]

MEAT CONSUMPTION IN BELGIUM

Kind of Meat	Consumption in 1923, Pounds	Per Capita, Pounds
Ox	49,448,413	6.45
Bull	18,666,752	2.43
Cow	78,362,955	10.22
Heifer	38,639,826	5.04
Veal	33,169,175	4.33
Total fresh beef and veal	218,287,120	28.47
Frozen beef	133,992,263	14.47
Total beef and veal	352,279,383	45.95
Pork, fresh	236,184,673	30.81
Pork, fresh and frozen	237,677,203	31.00
Mutton, fresh	4,502,428	.59
Lamb, fresh	851,725	.11
Mutton and lamb, frozen	63,726	.01
Total mutton and lamb	5,417,879	.71
Goat	1,298,027	.17
Horse	13,059,010	1.70
GRAND TOTAL	609,731,502	79.54

The available data on the increase of live stock in the last century taken in conjunction with what is known of the increased meat production per animal in neighboring countries lead to the tentative conclusion that meat eating increased materially during the earlier period of industrialization and rising wages. The war, of course, deprived many of their customary supplies. On the other hand, there seems little question but that many of the soldiers ate more meat during the war than at any other time in their lives. The use of frozen meats during the war did much to break down the prejudice against this

[102] *Consommation de viande de boucherie, 1923 et 1924*, Ministère de l'Agriculture et des Travaux Publics.
[103] *Ibid.*

form of foreign supplies and laid the foundation for what is now a flourishing import trade. The estimates of per capita consumption given above for 1923 compare favorably with the 70 pounds estimated to have been consumed in 1902.[104]

Belgium has for years imported considerable live stock for slaughter. In 1913, 61,853 cattle were imported. In 1923 there were 44,561. Sheep are also imported in considerable numbers.[105] In the first years of the century over 200,000 head of live stock were imported annually.[106] In 1923 it was reported that 3,000 hogs a week were being shipped in from Denmark.[107] Before the war the net imports of all slaughtered meats and fats for consumption averaged 27,132,000 pounds a year.[108] By 1924, this had increased to 246,772,000 pounds. In 1923, the net imports of frozen beef alone amounted to 138,598,000 pounds, largely from South America. In addition, 3,606,000 pounds of fresh beef were imported. Fresh pork imports were of minor consequence before the war. In 1923, however, 5,137,000 pounds were imported. Lard has for many years been imported extensively. The average pre-war purchases amounted to about 19,000,000 pounds a year of which about 90 per cent came from the United States. Apparently the peak in this movement came in 1921 with an import of 45,843,000 pounds. In 1923, 39,189,000 pounds were imported and in 1924 only 22,834,000 pounds. Oleomargarine and oleo stock are imported to some extent, but this trade has fallen from its pre-war level.[109]

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[104] Holmes, *op. cit.*, p. 273.
[105] See p. 583, *infra.*
[106] Rowntree, *op. cit.*, p. 183.
[107] *Commerce Reports*, July 16, 1923, p. 160.
[108] Wrenn, *International Trade in Meats and Animal Fats*, U. S. Department of Commerce, Trade Promotion Series, No. 26, p. 244; *Foreign Crops and Markets*, June 18, 1924, p. 540.
[109] *Ibid.*

Belgium will probably always import some meats and live stock for slaughter, but the present unusual trade is based upon a rapidly disappearing domestic shortage originating in the war. The yield of meat per animal as well as the numbers of animals has been below the prewar level. These abnormalities are passing rapidly and the continuation of the import trade will depend largely upon the prosperity of the masses of the population.

The Netherlands

The kingdom of the Netherlands is one of the most densely peopled nations of Europe. In a small country of 13,205 square miles there are about seven million inhabitants of whom nearly one half live in the cities. The situation of this country at the mouth of the Rhine and on the main highways of European commerce has proved the basis for commercial life in the cities which has been important for centuries. Commercial opportunities, however, have not been a discouragement to agriculture, which has been developed to a very high degree of intensification.

The Netherlands export meat to a considerable extent in spite of the density of the population. This was the outstanding example of a highly commercialized nation with only a small territory developing the live-stock industry to the point where an important surplus was produced for the outside market until disturbed by war conditions. Perhaps the clearest way to express the situation economically is to point out that, with an absence of natural supplies of fuel and minerals, the popular energies, which are usually turned toward industrialism in relatively crowded countries, have been turned toward those forms of agriculture which are most nearly comparable to manufacturing. The animal industry is heavily dependent upon imported feeds. To this degree it resembles any other industry which buys its raw material and sells a valuable

finished product. The animal industry of the Dutch farmers is very closely allied to all their other agricultural enterprises. The fertilizer obtained from animals fed on imported feeds is an unquestionably valuable source of fertility. Agriculture, horticulture and animal industry have worked hand in hand in Holland in the upbuilding of a prosperous and intensive rural economy that has absorbed the energies of the surplus population which in other countries, such as England, have been used in the factories.

The dike lands of the Netherlands are famous the world over, 38 per cent of the country being so low that an ordinary high tide would flood it.[110] These dike lands, or polders, have been reclaimed from the bottom of lakes, rivers and the sea by the labor of many centuries. Some of this land is automatically drained twice a day when the tide is low. Other sections again are so low that the water must be pumped up to sea level. In many cases it has been found impracticable to lower the water level to more than one or two feet below the surface of the soil. Such land cannot be cultivated successfully, but it makes some of the richest grazing grounds of Holland. Fields which can be better drained are suited to a general agricultural development. On such lands animal industry and farming go hand in hand. In southeastern Holland the country is entirely different. Here the country is hilly and the soil is poor. More extensive grazing has been customary in this region, but the animals found there, while hardier, are usually smaller than those on the lowlands.

The animal industry of the Netherlands has been increasing for the past century. The following table illustrates the live-stock population. Unfortunately, no data

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[110] J. W. Robertson Scott, *A Free Farmer in a Free State*, p. 123.

are available to show the changes in the meat production per animal.[111]

LIVE STOCK IN THE NETHERLANDS

Year	Cattle	Sheep	Goats	Pigs
1811	1,000,000	900,000	.....	244,000
1861	1,335,300	869,600	119,800	281,400
1870	1,410,800	900,200	136,900	329,100
1880	1,469,700	847,500	157,700	334,800
1890	1,532,800	819,400	164,800	578,700
1900	1,655,700	770,700	179,500	746,600
1910	2,026,943	889,036	224,231	1,259,844
1913	2,096,600	842,000	232,500	1,350,200
1915	2,390,000	.....	.....	1,487,000
1917	2,301,007	520,812	.....	1,185,565
1918	2,048,872	642,324	311,011	600,113
1921	2,062,771	668,211	272,298	1,519,245

It is not surprising that the cattle have doubled in the century, but it is rather surprising that the number of goats increased continuously until the end of the war and, in view of happenings in other countries, that the numbers of sheep have been so well maintained until the beginning of the war. The number of pigs has increased most strikingly, however, amounting to more than five times as many at the outbreak of the war as a century earlier. The shortage of imported feeds which came with the blockade in the last two years of the war shows its effects most strikingly on the pig population, which was cut to less than one half. The cattle and sheep also suffered. The post-war figures show the numbers of pigs not only restored, but the rate of their growth made up, in spite of the temporary decline. The chief depressing results remaining from the war appear in the smaller number of sheep, but this decline had started before the war and may have

[111] Data for 1811 from Alexander Reens, *De Vleesch Export van Nederland;* for 1861-1910, from Robertson Scott, *op. cit.*, p. 161; for 1913-21, from Wrenn, *op. cit.*

been influenced but little by this disturbance. The census figures for 1921 also, while showing increases in the breeding bulls, cows and other dairy stock, disclose a decrease in the number of fatted calves, other fatted cattle and young cattle over one year old.[112] Later data alone will reveal whether this indicates a tendency to give up the production of beef and veal in favor of more intensive dairying, or merely a temporary halt in meat production in order to build up the depleted herds.

The meat production of Holland centers around the dairy industry. Even pig raising is connected with dairying in spite of the relative importance of cheese manufacturing which leaves only the whey of the milk instead of the whole skim product left by the making of butter.

The meat animals are by no means a mere by-product of dairying. The beef is of uniformly good, but not excellent quality. Cows are carefully fattened for slaughter and the bulls are killed at a very early age. The quality of the meat is sufficiently good to be highly acceptable on the London market.[113] Calves are also very carefully fattened as three-months-old veal of the very best quality. The three breeds of cattle are not uniform in this usefulness for meat production. The Friesian cattle are not good meat producers. The Meuse-Rhine-Ijsel cattle are described as equally good for milk and meat, while the Groningen cattle are said to be superior for meat production. The pigs are largely produced to cater to the best demands of the fresh pork trade, both domestic and foreign, although pork is also produced for the bacon trade. The mutton and lamb industry cannot in any sense be classed as a by-product of dairying. This industry was formerly important in the poorer regions of the east, although it was still more highly developed in the rich sec-

[112] Wrenn, *International Trade in Meats and Fats*, p. 73.
[113] Mackenzie, *Cattle*, p. 4.

tions of the low country.[114] This product also was of sufficiently high quality to find its chief foreign outlet on the discriminating British market.

There is no extensive grazing in Holland, as grazing is known in the New World. Practically all the farms are intensively cared for except in the poor lands in the east. The farms are small as a rule, from 70 to 90 per cent of the soil being cultivated by farmers with less than 50 acres. Grassland has been plowed up to a certain extent in recent years to make way for cultivated crops. This, however, may be a passing movement due to the effects of the war. Grain is grown on a large part of the cultivated land, but, while formerly this was grown for sale, it is now largely used for feeding the stock.[115] The grain grown is largely rye, oats and barley, and there is a very considerable production of both potatoes and sugar beets which afford important supplies of fodder.

It is worth noting that the three provinces which have the greatest density of human population, North and South Holland and Utrecht, also have the most cattle to the square mile, and South Holland had twice as many sheep per square mile as any other province in pre-war times. The provinces of Groningen and Zeeland have the least cattle and pigs per square mile and are relatively lightly populated.[116]

Holland imports considerable quantities of grain and other feed for her live stock. The pre-war annual import was estimated to amount to about two million tons.[117] The following table shows the pre-war and recent net imports of coarse grains and oil cake. In addition to these feeds the live stock have the milling offals from an average

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[114] J. J. Fieth, *Modern Holland,* pp. 96-105.
[115] *Ibid.,* p. 83.
[116] Robertson Scott, *loc. cit.,* and Fieth, *loc. cit.*
[117] Eltzbacher Report, p. 13.

net import of about twelve and three-quarters million bushels of wheat and about seven million bushels of rye.[118]

NET IMPORTS OF FEED IN THE NETHERLANDS

Feed	Average, 1909-1914	1922	1923	1924
Corn, bushels	21,736,000	39,911,000	30,618,000	29,173,000
Oats, bushels	8,091,000	3,874,000	4,508,000	5,367,000
Barley, bushels	11,064,000	6,261,000	8,663,000	14,711,000
Oil cake and meal, pounds	487,297,000	297,976,000	398,395,000	.....

Two things of importance appear in this table.[119] The net imports of coarse grain for feed have been increased materially since the war. The normal use of the oil cake, which is useful in building up the productivity of the soil, has been very large and the indications are that this use is being rapidly restored to former levels. The Dutch have a very strong prejudice in favor of the use of linseed cake as a feed. In pre-war days about five hundred pounds were fed per head of cattle. This is said to be unequaled in any other country[120] in the world.

The consumption of meat is light, but is increasing markedly. In 1914, the per capita consumption amounted to 35.08 pounds. In 1919, it had fallen slightly to 34.83 pounds. After that it rose rapidly to 45.77 pounds in the year 1922.[121]

The export trade of meat products is very important, considering the size of the country.

Sheep were imported from Germany during the period

[118] *Annuaire international statistique d'agricole,* 1909-21, pp. 252-269.

[119] *Foreign Crops and Markets,* Nov. 26, 1924, p. 565.

[120] *Cottonseed Products and Their Competition in Northern Europe,* U. S. Department of Commerce, Special Agents Series, No. 84, p. 67.

[121] Files of U. S. Department of Commerce (Special report to Mr. Wrenn).

1896-1910 for slaughter for the British mutton market.[122] This trade disappeared later, however, and the average year before the war showed no imports of consequence of any of the meat animals. There was an average export of 75,198 cattle and calves, 97,528 sheep and 125,200 pigs. During the war this trade became unimportant. Since the war it has recovered to a considerable degree.

The pre-war export of beef and veal was largely to Germany and the United Kingdom. These countries shared about equally in the trade, but the share of the former was increasing at the expense of the latter. During the war all such trade, of course, was seriously affected. In 1919, the pre-war importance of this trade was restored, most of the product going to Germany and Austria. Since then it has experienced a depression, but sales to the United Kingdom have been increasing. Immediately after the war refrigerated beef was imported. Recently the trade in beef originating chiefly in South America and Australia has been large. Denmark has also supplied fresh and chilled beef. There is no reason to expect that this import trade will continue to be extensive when the cattle industry of the Netherlands is fully restored.

The export of tallow in pre-war days was greater than that of beef and veal, amounting to approximately 72,000,000 pounds, of which Germany took over 70 per cent. This trade has not as yet been restored to its former proportion. Oleomargarine was also exported heavily before the war. This product is based partially upon animal oils and partially upon the vegetable oils produced in conjunction with the oil-cake industry of the country. The commerce in oleo has also failed to reach its pre-war importance. The imports of these fats have been materially greater than the exports.

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[122] Reens, *De Vleesch Export van Nederland*, p. 36.

The pre-war export of mutton and lamb went largely to England. In the early part of the war it was diverted to Germany. The decrease in the flocks leaves little opportunity for an early restoration of this trade.

Pork is largely exported in the fresh form. The nearness of the Netherlands to the markets of England and Germany has given this country a great advantage in the trade of this highly perishable meat. A refrigerated transportation service was inaugurated in 1924. The pre-war trade of over sixty million pounds went largely to the United Kingdom, which took 72 per cent. Germany took 23 per cent and the remainder went largely to France. By 1922, the pre-war amount of trade had been recovered, England taking more than usual and most of the remainder going to France and Belgium. By 1922, this trade had grown to 174,498,000 pounds with France as the best customer, followed by Great Britain and Germany. During the year 1926, Great Britain placed an embargo on all continental fresh pork on account of an outbreak of disease and, as a result, bacon was substituted for fresh pork in the exports to that country.

Small amounts of cured pork were exported before the war, largely again to Britain and Germany. Recent sales to the latter country have been small; but the growing demand from England has brought the trade to above the pre-war level. Cured pork has also been imported to a certain extent. In 1919 this import movement made quite a showing, but has since tended to disappear and will probably not recover in view of the increase in the number of pigs within the country.

The quantities of exported lard were almost as important as fresh pork before the war, amounting as they did to about 52,000,000 pounds a year with a definitely increasing trend. War disturbances disrupted this trade and, since Germany was the best customer, it did not

recover its pre-war status until 1923. The year 1924 saw record shipments.[123]

The importance of the meat industry of the Netherlands shows no tendency to diminish. The projected drainage of the Zuider Zee and the more intensive development of the eastern higher regions will ultimately afford opportunities for further expansion of production. The industry in the lowlands is already developed intensively, but there is no assurance that the limits of development have been reached as yet. There is a real question as to which will expand the faster, the meat production or the local demand. The economic conditions of Holland point to the probability that live-stock products will, for some time to come at least, continue to be among the products which can be produced most efficiently for the export market. The chief limiting factors, in addition to the expansion of local demands with the growth of the population, will be the price of competing products in the world's markets and the availability and cost of the feeds which constitute so large a part of the raw material of the industry.

Denmark

Denmark is the outstanding example of a nation which has rendered itself prosperous by the development of an intensive live-stock industry built heavily upon imported feeds. When other nations solved the problems accompanying increasing density of population by enlarging their factory production, Denmark, having none of the natural resources requisite to such an economy, built up an elaborate animal industry which buys much of its raw material abroad and sells the surplus of its highly finished products in the best available outside market. The resulting national prosperity manifests the possibilities which

[123] Wrenn, *op. cit.*, pp. 72-79, 239.

there are for profit when any community as a whole, in the more settled countries, devotes its best energies to the development of a type of farming akin to manufacturing.

Denmark's southern boundary is about 54½ degrees north latitude, but the fact that it consists of a small peninsula and several islands set in the midst of waters from which the influences of the Gulf Stream have not been wholly removed, gives it a temperate climate, cool in summer and comparatively mild in the long winter. The rainfall is favorable to agriculture, but all authorities agree that Denmark was not blessed by nature with fertile land. Much of the soil is comparatively sandy and poor. Aside from certain exceptional regions, such as the polders on the seacoast, the present comparative fertility of the country has been built up by artificial means.[124]

Danish agriculture has passed through many vicissitudes. Before the end of the eighteenth century its agriculture was conducted under almost communistic conditions. The work of farm production itself was coöperative. The village community in joint action decided how the fields were to be cultivated and how the cattle were to be tended. Except for very small plots attached to the farmstead, the fields were held in common and distributed each year in scattered strips to the various villagers. Practically no progress was possible, for no one could experiment with new methods when his farming was subjected to the hard and fast system of the crop rotation of the community. Technical improvements in the use of machinery, better cropping systems and soil improvement were practically impossible under such communistic conditions. This system broke down at the end of the eighteenth century and private ownership of farming land

[124] C. L. Christensen, *Agricultural Coöperation in Denmark,* U. S. Department of Agriculture (1924), p. 5.

was established. Practically unlimited coöperation in the production of farming harbored so many inefficiencies that it collapsed in the face of the competition that came with the development of modern agriculture. In the last half of the last century agriculture confronted difficulties common to all farming in the Old World, but farming methods were improved and grain growing for export was profitable for a time after the repeal of the British Corn Laws. Fortunately the live-stock industry was being established at the same time, for the grain shipments from the New World soon made grain growing unprofitable. Cattle and pork were exported chiefly to Germany. The wars with Germany affected this latter trade and in 1879 the fiscal policy of that country began to impose serious tariff restrictions upon it. Prices of farm products were also falling rapidly. Danish agriculture was not in fortunate circumstances. In 1882, a coöperative butter factory was established that served as a model for the marketing of all the leading farm products. The coöperative movement was launched and Danish agriculture entered a new and a prosperous era.[125] In the new order, farm production is conducted strictly on the basis of private ownership and management—as a rule on moderately sized farms and small holdings. Community effort is highly developed in the marketing of the products, in the purchasing of farm supplies, in popular education and in the development of national programs of production. These latter are in no sense compulsory. They have been outlined by leading citizens and have met with wide popular adoption. In farm production, community effort appears in the various breeding societies and cow-test associations. It also appears in the building up of the breeding stock of pigs. However, the actual farming is conducted on the indi-

[125] H. Faber, *Coöperation in Danish Agriculture*, pp. 3-54.

vidualistic basis with private ownership, where a man's own work directly affects his personal profits. An excellent system has been evolved of private operation for those matters which can best be managed privately and joint effort in those matters which require large-scale effort for the greatest economies.

The development of the modern coöperative movement and that of the live-stock industry of Denmark have gone hand in hand. The following table shows the increase in the numbers of cattle and pigs and the decrease in sheep since 1861.[126]

NUMBERS OF LIVE STOCK IN DENMARK, 1861-1924

Figures for Pre-War Denmark, Not Including Northern Slesvig Which Was Returned to the Country in 1920

Year	Milk Cows	Total Cattle	Pigs	Sheep
1861	757,000	1,119,000	301,000	1,752,000
1871	808,000	1,239,000	442,000	1,842,000
1881	899,000	1,470,000	527,000	1,549,000
1893	1,001,000	1,696,000	829,000	1,247,000
1898	1,067,000	1,745,000	1,168,000	1,074,000
1903	1,089,000	1,841,000	1,457,000	877,000
1909	1,282,000	2,254,000	1,468,000	727,000
1914	1,310,000	2,463,000	2,497,000	515,000
1918	1,024,000	2,124,000	621,000	470,000
1919	1,046,000	2,188,000	716,000	509,000
1920	1,113,000	2,286,000	1,008,000	504,000
1921	1,184,000	2,235,000	1,327,000	484,000
1922	1,219,000	2,302,000	1,734,000	415,000
1923	1,265,000	2,307,000	2,566,000	354,000
1924	1,272,000	2,434,000	2,597,000	285,000

Figures for Entire Denmark Including Northern Slesvig

1920	1,196,000	2,505,000	1,116,000	540,000
1921	1,272,000	2,591,000	1,430,000	522,000
1922	1,311,000	2,525,000	1,899,000	442,000
1923	1,339,000	2,523,000	1,855,000	374,000
1924	1,369,000	2,667,000	2,868,000	302,000

[126] *Statistisk Aarböger*, Det Statistiske Department, Copenhagen, Denmark.

Evidently, with the development of Danish agriculture, the sheep are disappearing. Formerly much of the land was of the type customarily used for nothing but extensive sheep grazing. To-day there is little or no extensive use of the land. In the intensive live-stock management sheep do not, as a rule, compete favorably with other animals, although some are raised under the most intensive conditions in Denmark. Just before the war the sheep industry had declined so far that more than twice as much mutton and lamb was imported as exported.[127]

The increase in the numbers of milk cows between 1880 and 1914 just kept pace with growth in the human population. The numbers of other cattle, largely calves and young stock, doubled, and the numbers of pigs expanded to 474 per cent of the stock in 1880, while the milking stock increased by only 46 per cent. In the same time the productivity per acre of all crops reduced to a common measure of feeding value increased by 66 per cent.[128]

Dairying is regarded as the principal factor in the live-stock industry of Denmark. Butter was the leading export among animal products in the last pre-war year, as it still is.[129] Dairying also is considered to be the basis for the existing meat industry. There can be no question but that most of the pork, beef and veal production is related to the dairy industry to a very great extent. However, if meat production is a mere by-product of milk, in the light of the statistics given above, the by-product is tending rapidly to outgrow the main product. Milk production, of course, has increased more rapidly than the number of cows, for the yield of the cows has been improved. Apparently the

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[127] See p. 583, *infra*.

[128] *A Short Outline of Danish Agriculture through the Last Generation*, a pamphlet presented to the British journalists on their visit to Denmark in August, 1919, by the Union of Danish Agriculture.

[129] *Statistisk Aarböger.*

milking capacity of the cows has increased so much that the total milk production in 1914 was about 227 per cent of that in 1880. On the other hand, the meat yield per head of the animal population has unquestionably increased also. Moreover, the export of dairy products has maintained its lead over any single category of meat only by reason of the fact that the Danes sell their butter while eating margarine made from the vegetable oils which are produced as a by-product from the oil cakes fed to the cattle. Were it not for this substitution of margarine for butter in the domestic diet the value of the butter exports would be of less value than the exports of pork products alone.

There is no indication that the relation between dairying and pig production is disappearing. Skim milk, pasteurized and returned from the coöperative butter factory and fed in conjunction with home-grown and imported barley and sugar-beet refuse, is the basis for the growing ration of the Danish pig. The fattening process depends largely upon corn from the United States or the Argentine.[130] Most farmers keep pigs and the average number per farm is only ten. Nevertheless, there are some farmers who raise pigs on a large scale, some raising over one thousand a year.[131]

The Danish pig requires the surplus milk from the dairy industry, but it holds a position of independent importance in the national economy. No better proof of this fact is necessary than the great national attention devoted to its breeding. Formerly the Danes produced a fat pig suited to the demands of the German market. When, as we have seen, this market was being closed, the leaders of thought turned their attention to England, learned what

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[130] *Commerce Reports*, U. S. Department of Commerce, Oct. 9, 1922, p. 85.

[131] H. R. Haggard, *Rural Denmark*, p. 29.

kind and quality of pork product that market wanted and laid the foundation for a supply of such a product in new breeding practices. The British market wanted a long, fairly lean pig, not a fat hog. The Danish breeders saw to it that this was supplied. The old Danish breed of pigs was hardy and suited to the living conditions of the country. It was decided to retain the breed, but to alter its characteristics somewhat and produce a market stock from the first cross between this breed and an imported stock of English Yorkshires. The most successful farmers in the country in the art of breeding pigs are systematically selected competitively to produce breeding stock. Separate breeding establishments are maintained for the native breed and for the Yorkshires. The animals from these breeding farms are then purchased by the producers of market stock to serve as the source of their young pigs. The first cross between the native sows and the Yorkshire boars has been found to yield the most satisfactory market stock.[132]

The production of pork, which became very much smaller during the war, is now very much above the pre-war level. The hogs slaughtered in export houses numbered 4,024,000 head in 1924, and in 1925 the number was 3,766,000. Even this smaller number was more than a million head greater than the average for the years 1911 to 1914. During the first half of the year 1926 the slaughterings continued to decrease, but the stock of pigs in the country rose to the highest level ever recorded.[133]

The production of beef and veal is largely a joint industry with dairying. The cattle industry is so organized

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[132] Wrenn, *International Trade in Meats and Animal Fats*, U. S. Department of Commerce, Trade Promotion Bulletin, No. 26, pp. 100-107.

[133] *Foreign Crops and Markets*, March 29, 1926, p. 389; Oct. 8, 1926, p. 517.

that, to a considerable extent, the relative emphasis may be shifted from dairying to meat production when price variations call for a change. In 1925, 240,193 large cattle, 158,092 fat calves and 100,664 lean calves were slaughtered in export slaughterhouses.[134] This would indicate that the larger proportion of the calves not raised was fattened before slaughter. No statistics are available showing the exact importance of the various classes of adult cattle among those slaughtered at home or exported. Certainly the discarded cows and bulls, when fattened, play the largest part in such marketings. They do not complete the story, however. The west coast of Denmark and the neighboring territory of Germany have a flourishing grass-fattening industry where store cattle, both steers and heifers, are fattened on the rich pastures of the polders. Some of the animals so fattened are from the dairy herds, but many of them are Shorthorns which are fairly popular in Denmark in spite of the fact that they are poorer milkers than the native cattle. There is an important industry in the belt of poor land just inside the polders along the west coast of the Jutland peninsula which raises store cattle for these finishing pastures.

The attention of the Danish farmer has turned more and more to the raising of fodder for his animals and away from the production of grain for his own personal consumption. This tendency persists in spite of the fact that the increase in fertility of the soil which has accompanied the growth of the live-stock industry has raised the average yield of wheat per acre to above forty bushels. During the summer the cattle are put out on the artificial pastures. To a large extent they are tethered instead of being turned loose in the fields. The grass is thus utilized evenly and

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[134] *Foreign Notes on Meats, Fats, and Oils,* U. S. Department of Commerce, March 19, 1926, p. 11.

thoroughly, the cows being moved along the field as the forage is eaten.[135] In the cooler weather the cattle are covered with canvas blankets. In the poorer districts the cattle are turned loose in natural pastures.[136] Permanent grass covers about one-seventh of the total area devoted to grass and cultivation. During the period from 1888 to 1912 the permanent grass increased at the expense of the cultivated land. Grass and clover in the crop rotation decreased somewhat during that time, but the area devoted to potatoes and other root crops increased rapidly, while the area in grain remained practically constant.[137]

During the period of war and reconstruction there has been an especial tendency in the raising of farm crops, toward production of animal feed rather than food for direct human consumption.[138] The production of bread cereals has declined while feed cereals increased. The production of root crops has increased as a whole by more than 50 per cent, even when the area devoted to potatoes and sugar beets decreased. The Danes have been making their farms increasingly an auxiliary to their animal industry.

The accompanying table shows something of the dependence of the live-stock industry of Denmark upon feeding stuffs grown in other countries. The importation of coarse grains is large and growing larger and the use of the protein concentrates made from oil-bearing seeds is very great and is increasing. Among the latter the leading place before the war was taken by cottonseed products from America and sunflower-seed products from

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[135] Haggard, *op. cit.*, p. 3.

[136] *International Review of the Science and Practice of Agriculture*, 1924, July-September, p. 683.

[137] Faber, *op. cit.*, p. 163.

[138] *Foreign Crops and Markets*, U. S. Department of Agriculture, March 5, 1924, p. 177.

Russia.[139] The supplies of the latter were cut off for a time, of course, during the war, but available evidence, such as it is, indicates that Russia is producing several times as much oil seed as in pre-war years.[140] Denmark also imported approximately four million bushels of wheat and about seven million bushels of rye before the war.

NET DANISH IMPORTS OF CORN, OATS, BARLEY AND OIL CAKE,* AVERAGE FROM 1909 TO 1913, AND ANNUAL FROM 1920 TO 1925, IN THOUSANDS

Year Ending December 31	Corn, Bushels	Oats, Bushels	Barley, Bushels	Oil Cake,† Pounds
Av. 1909-1913	11,434	3,975	1,463 ‡	986,552
1920	9,817	189	880 ‡	569,249
1921	18,171	712	914 ‡	803,599
1922	17,297	306	74	843,518
1923	13,208	850	9,849	1,235,254
1924	16,793	2,540	4,581	1,528,827
Av. 1920-1924	15,057	919	2,542	996,089
1925	17,978	1,865	1,856	1,646,774

* Compiled from *Vareomsaetningen med Udlandet.*
† Does not include soy bean cake.
‡ Net export.

The milling offals from this also furnished valuable protein concentrates for the live stock. Some light on the question of the degree of dependence of Denmark upon outside supplies of feed appears from the fact that during the blockade which stopped the import of feed in the latter part of the war the exports of animal products practically disappeared. On the basis of the feeding value of the imported as compared with the home-produced fodder it is estimated that about 40 per cent of the animal products of Denmark are based upon imported feed.[141]

[139] *Cottonseed Products and Their Competitors in Northern Europe,* U. S. Department of Commerce, p. 80.
[140] See *Foreign Crops and Markets,* Nov. 26, 1924, p. 561.
[141] Estimate by Chris. L. Christensen.

The total meat production of Denmark is not given in any official statistics. A considerable quantity of the beef and veal is exported alive and there is no completely accurate knowledge of its equivalent in dressed meat. Faber has made estimates of the production and consumption of meat in Denmark that are probably fully as accurate as the official statistics of most other countries. The following table based upon his estimates shows the domestic production of meats and the meat equivalent of exported live stock. It is noteworthy that the larger part of the beef and veal goes into home consumption while two-thirds of the pork is exported.

PRODUCTION OF MEAT IN DENMARK, IN POUNDS

Products	1909-1913	1922
Beef and veal:		
Home consumption	122,576,000	187,391,000
Export	114,485,000	90,389,000
Total	237,061,000	277,780,000
Mutton and lamb:		
Home consumption	22,487,000	19,158,000
Export	397,000	154,000
Total	22,884,000	19,312,000
Pork and bacon:		
Home consumption	125,111,000	121,738,000
Export	248,194,000	245,592,000
Total	373,305,000	367,330,000
Edible offal	68,453,000	71,319,000
Poultry	17,571,000	23,788,000
Total	719,274,000	759,529,000

The consumption of meat, which, in spite of large exports, contains small quantities of foreign supplies, is shown in the following estimates made by the same authority.

MEAT CONSUMPTION IN DENMARK, IN POUNDS

Product	1909-1913		1922	
	Total	Per Capita	Total	Per Capita
Beef and veal:				
Home produced	122,575,760	....	188,493,300	....
Import, less re-export	7,076,766	....	330,690	....
Total	129,652,526	47.02	188,823,990	57.58
Mutton and lamb:				
Home produced	22,486,920	....	19,157,974	....
Import, less re-export	3,185,647	....	24,251	....
Total	25,672,567	9.32	19,183,125	5.85
Pork and bacon:				
Home produced	125,111,050	....	121,738,012	....
Import, less re-export	1,792,340	....	5,070,580	....
Total	126,903,390	46.02	126,808,592	38.67
TOTAL	282,228,483	102.36	334,815,707	102.10
Edible offal	37,103,418	13.45	51,014,444	15.55
Poultry:				
Home produced	17,570,662	....	23,787,634	....
Import, less re-export	1,984,140	....	859,794	....
Total	19,554,802	7.09	24,647,428	7.51
GRAND TOTAL	338,886,703	122.90	410,476,678	125.16

As usual on the Continent, there is a large consumption of veal as compared with that of beef. Before the war about two-thirds as much veal as beef was used. In the year 1922 the comparative use of beef was somewhat greater. Conditions had hardly become normal again by 1922 and the use of beef was unusually heavy while that of pork was unusually light.[142]

Great Britain has afforded the chief market for Denmark's increasing exports of pork products. As already

[142] Harald Faber, "Agricultural Production in Denmark," *Journal of the Royal Statistical Society*, Vol. LXXXVII (January, 1924), pp. 22-62.

noted, the Danish pig breeders have systematically developed a type of pig that will produce the kind of bacon the Englishman wants most. The methods of preparing this bacon and its manner of marketing are all fitted as carefully to the British demand. As a consequence, in the pre-war years the United Kingdom purchased over 85 per cent of the surplus pork products of Denmark, chiefly in the form of bacon known as "Wiltshire sides." In 1923 it took 98.8 per cent of the supplies.[143] This extreme dependence upon a single market involves some dangers, but no other country offers a suitable market for any great proportion of the product. This trade increased continuously, with but minor setbacks, from the eighties until 1914 when 313 million pounds were exported altogether, 312 million pounds of which went to Britain. The years 1918 and 1919 saw almost no such trade. After that the amounts shipped grew by leaps and bounds until in 1923 even the high record of 1914 was exceeded.[144]

In the average pre-war year 39,959,000 pounds of beef and veal, exclusive of tallow, were exported and 11,754,000 pounds imported. At the same time 139,323 cattle and calves were exported and 14,306 imported. Germany is the chief market for both cattle and beef and veal, followed by Czecho-Slovakia, Belgium, Switzerland and Italy. In the average of the years 1921 to 1923, 2,907,000 pounds of such meat were imported and 30,303,000 pounds were exported. At the same time only 165 cattle were imported and 114,961 exported.[145]

Apparently Denmark will continue her production of meats, and all present indications point to the rate of the expansion of the market as the chief limiting factor in the further development of this industry. The foreign

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[143] *Andelsbladet*, January 11, 1924.
[144] Wrenn, *op. cit.*, pp. 274, 275.
[145] *Ibid.*, pp. 272-283 and 577, *infra*.

supplies of feed are essential to continuance as well as expansion. Anything that may limit them in the future will limit the output of meat. The land of Denmark supplies a limited basis for the production of the essential fresh fodder, but the increased fertility which is aided by the use of more and more feed and direct application of artificial fertilizer is serving to increase the productivity of the soil. The future possibilities of this source of meats are limited, but the limits seem as yet to be in the fairly distant future. So long as Denmark continues her present efficient coöperative-marketing policies her bacon at least may be expected to hold a premier position in world competition.

Germany

The meat situation in Germany is interesting, not only for its real domestic importance but also for the light which it sheds upon the meat problem of the civilized world. Probably no other country made more rapid strides in industrialization in this last half century than did Germany, and yet her animal husbandry as well as her agriculture in general also made very rapid progress before the war. The reaction to the competition from the newer agricultural countries, which reached its climax in the nineties, produced a greater intensification of home agriculture and a rate of increase of production of staple foods surpassing even the increase of her population. Likewise the effect of the war and subsequent unsettled conditions show something of the effect which a period of stress may produce upon the meat industry of a civilized nation.

CONSUMPTION

The consumption of meat in Germany increased very rapidly in the century before the war. The development

of industrial life increased the purchasing capacity of the average citizen. At the same time an increased per capita home production, coupled with larger potential supplies from other nations, greatly augmented the supply of meat. The annual per capita German production at various periods throughout this century is shown in the following table:[146]

PER CAPITA PRODUCTION OF MEAT IN GERMANY

Year	Pounds	Year	Pounds	Year	Pounds	Year	Pounds
1816	29.92	1861	51.04	1883	64.46	1900	75.48
1840	47.52	1873	64.9	1892	71.5	1907	101.64

The consumption, of course, depends not only upon production, but upon foreign trade as well. The net foreign trade in live stock and meat, reduced to meat equivalents, is unfortunately not available for those various years in the past. The report of the Eltzbacher Committee indicates that nearly 10 per cent of the meat supply was secured from abroad immediately prior to the war.[147] The difference between actual consumption and these production figures for earlier years cannot be ascertained exactly. In the discussion of Great Britain's supplies of meat half a century ago, it appeared that at that time Germany exported live stock, especially sheep, in considerable numbers. However, she also imported heavily from Russia during the same period.[148] The evidence is neither complete nor conclusive as to the meat equivalents in imports and exports, but it would appear that the net imports of recent years were added to the increased per capita

[146] P. Eltzbacher, *et al.*, *Die deutsche Volksernährung und der englische Aushungerungsplan* (English version edited by S. Russell Wells), p. 188.

[147] *Ibid.*, p. 62.

[148] J. J. Polferoff, *Materials for the Revision of the Russo-German Treaty*, Russian Ministry of Finance, 1914.

production shown above. Certainly the average per capita meat consumption of the Germans increased to about three and one half times its former proportions within the last century.

In the Kingdom of Saxony, in which careful data have been kept in connection with taxes on slaughterings, the following record is found of per capita meat consumption for the major part of the last century.[149]

PER CAPITA MEAT CONSUMPTION IN SAXONY

Year	Beef, Pounds	Pork, Pounds	Total, Pounds
1840	4.6	17.6	22.2
1850	15.6	25.9	41.5
1855	16.1	16.7	32.8
1870	19.8	29.9	49.7
1880	24.4	39.8	64.2
1890	30.8	45.3	76.1
1895	30.1	51.7	81.4
1900	33.4	61.4	94.8

The Germans normally eat a relatively large amount of pork and a small amount of mutton and lamb. Their consumption of beef is not heavy. In 1909, the average German ate 67.4 pounds of pork, 45 pounds of beef and veal, and 2.3 pounds of lamb and mutton. He also ate some horse meat and considerable poultry. Compared with this, we find a consumption of 94.2 pounds of pork, 99.9 pounds of beef and veal and 7 pounds of mutton and lamb in the United States and 33 pounds of pork, 60 pounds of beef and veal and 26 pounds mutton and lamb in the United Kingdom in the same period.[150] It also is worth noting that out of a total net import of 335,700

[149] Herter and Wilsdorf, "Die Bedeutung des Rindes für Fleischerzeugung," *Arbeiten der deutschen Landwirtschafts-Gesellschaft*, Heft 206, s. 17.

[150] Holmes, *Meat Situation in the United States*, U. S. Department of Agriculture, Bulletin No. 109, p. 272.

tons of meat and fat in the pre-war years, 161,700 tons were included in the category of "lard, etc." The German before the war was a heavy eater of fats. He was a heavy consumer of food in general, consuming 4,779 calories per "average man" as compared with the 3,410 calories in the United Kingdom and 3,600 in France, 3,130 in Italy and 4,361 in the United States.[151] This heavy general consumption apparently is comparatively new. Not only did the production of meat increase by 129.1 per cent from 1883 to 1911; the production of grain increased a little more than 100 per cent in the same period and potatoes by 113 per cent.[152] A very large sugar production also was developed. Since the population increased by only 43 per cent from 1880 to 1910, it is evident that food production was increasing very much more rapidly than the numbers of its users. Imports were also growing. There is every indication that all this increased per capita production, with enlarged imports, became the basis for an increased per capita consumption. The per capita consumption of meat in 1912 has been estimated at 130 pounds. This seems to be the high point in the movement. The war decreased consumption very greatly. Even in the average of the years 1921 to 1923 the amount consumed was only 87.1 pounds, and in 1923, 78.4 pounds.[153] The data presented on page 265 show an advance to 88.8 pounds of beef, veal, pork, mutton and lamb in 1924. In the year 1925 there were more plentiful supplies from home slaughterings and the imports also

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[151] Eltzbacher, *op. cit.* (English Introduction by Waller); Commission Scientifique Interalliée du Ravitaillement, *Premier rapport*; R. Pearl, *The Nation's Food*, p. 247.

[152] Middleton, *The Recent Development of German Agriculture*, pp. 8, 60.

[153] R. H. Hess, *Economic Needs of Germany and Surplus Farm Production in America*, U. S. Department of Agriculture, mimeographed report, 1924.

were greater than in 1924.[154] The recent tendency is toward a smaller pork supply and a relatively increased supply of beef. The slaughter of calves and young beef animals has increased to more than pre-war proportions. This also is true of this slaughter of sheep and lambs.[155] It is estimated by competent authorities that the total consumption of meat in 1925 was about 80 per cent of that just before the war. This would mean a recovery to about 104 pounds average per capita consumption. In the first quarter of the year 1926 the consumption was restored to about 97 per cent of the pre-war amount.[156]

PRODUCTION

Meat production in Germany is, as a rule, part of a system of fairly intensive agriculture. The agricultural depression of the last quarter of the past century bore grievously upon the farmers in Germany as well as on those in other lands. Many were forced out of business and those who remained, by hard work, rigid economy and the adoption of better technical methods of farming, laid the foundations for a better agriculture.[157]

Germany did not follow the policy of seeding down farm land to pasture as did England, partially because her lands were not so well adapted to such use as are those of the latter country but largely because of her settled policy of maintaining the nation's agriculture. The area of arable land remained about constant, the meadows increased slightly and the good pastures have

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[154] *Foreign Notes on Meats, Fats, Oils and Livestock,* U. S. Department of Commerce, March 19, 1926, p. 3.

[155] *Foreign Crops and Markets,* U. S. Department of Agriculture, March 29, 1926, p. 422.

[156] Reichs-Kredit-Gesellschaft, Report on Germany's Economic Position at the End of 1925 and Beginning of 1926; *Foreign Notes on Meats, Fats, Oils and Livestock,* U. S. Department of Commerce, July 23, 1926, p. 2.

[157] Middleton, *op. cit.,* p. 50.

also increased. The poor pastures, on the other hand, decreased very markedly.[158] The increased production of meat in Germany was not at the expense of the production of field crops; it was a part of a development of arable agriculture. German experience of the past half century proves that an increasing intensification of farming and crop production need not drive out animal husbandry.

The greatest increase in live stock came in the hog production. From 1883 to 1912 the hog population increased by 137.7 per cent. The productivity per animal increased so much that the pork production increased by 182 per cent. In the same time cattle increased by 27.7 per cent, beef production by 92.7 per cent and veal by 143.7 per cent. Sheep, on the other hand, decreased by 69.8 per cent and the production of mutton by 55 per cent.[159] This increase in pigs and cattle with a decrease in the sheep was the natural outcome of more intensive agriculture. Sheep raising has always been more important on the large estates while pigs and cattle are kept more abundantly on the smaller farms of the peasants.

War conditions injured the animal husbandry of Germany. The following table shows the pre-war and present estimates of the animal population within the present boundaries:[160]

German Live Stock, Pre-War and Recent Numbers

Year	Cattle	Hogs	Sheep	Goats	Horses
1925	17,182,724	16,159,766	4,741,897	3,792,429	3,914,820
1924	17,326,098	16,894,874	5,735,147	4,359,642	3,855,176
1922	16,315,541	14,678,285	5,566,249	4,140,199	3,650,475
1921	16,790,699	15,817,819	5,891,029	4,295,548	3,665,982
1913	18,474,377	22,533,393	4,987,828	3,163,813	3,806,705

[158] *Ibid.*, p. 63.
[159] *Ibid.*, pp. 59, 60.
[160] *Foreign Notes on Meats, Fats, Oils and Livestock*, U. S. Department of Commerce, Feb. 19, 1926, p. 2.

It is surprising that the numbers of live stock were not more seriously reduced than these figures show. The cattle were reduced only moderately and the swine not so drastically as would have been expected. Sheep and goats, on the other hand, actually increased during the war, the former reaching their greatest number in 1920 and the latter in the year 1918. The number of these animals is again falling off as other animals increase. It is very interesting to note that this type of animal husbandry which diminished so markedly in Germany's era of agricultural expansion increased in the war depression when the number of other stock diminished. The sheep among all the major meat-producing animals competes less with man in the food which it eats. The pig competes the most. Germany's agricultural expansion increased the hogs and diminished the sheep; her war depression reversed the procedure.

The curtailment of production during the war was evident not only in the diminution of the live-stock population, but as certainly in the diminished weight of the animals at slaughter. The following table shows the decreased weight per animal through the war period:[161]

SLAUGHTERING WEIGHT OF ANIMALS IN GERMANY, IN POUNDS

Date	Cattle	Calves	Sheep	Pigs
Average slaughter weight before the war	550	88	48	187
Last 3 months of 1916	462	86	40	183
First half of 1917	427	68	37	170
Second half of 1917	354	66	40	130
First half of 1918	301	59	37	114
Third quarter of 1918	293	68	35	130
1920	341	..	..	170
1924	495	90	51	194

[161] Sir Ernest Starling, *Journal of the Royal Statistical Society*, 1917, p. 230. *Foreign Notes on Meats, Fats, Oils and Livestock*, Feb. 13, 1925, p. 24.

War conditions brought a great change. Foreign supplies were cut off almost entirely and the domestic production declined very seriously. Added to these difficulties there was a very serious lack of efficiency in the distribution of what supplies were actually produced. Accumulated stocks of food were drawn on at first and it was only in 1916 that real want appeared. In the spring of that year a shortage of meat and fats appeared. By the autumn of the same year the ration of all foods distributed was reduced to 1,344 calories per capita with only 31 grams of protein.[162] Since the war, conditions have improved materially. Nevertheless, even in 1920, German authorities claimed that their people had only 55 per cent as much food available per capita as they had in 1913 and their supplies of meat and animal fats were reduced to 38.3 per cent of the pre-war consumption.[163] Their consumption of this type of food was reduced to approximately the level of the early part of the last century. Disturbances in the systems of distribution made the effect upon certain sections of the population even more serious than portrayed by the bare statistics which apply to the average.

The following table, based upon data secured by a representative of the United States Department of Agriculture, strikingly portrays the situation arising from depleted numbers of live stock and their greatly reduced productivity. The reduced purchasing power of the nation has also affected the imported supply, an appreciable portion of which formerly came from German territories alienated since the war:[164]

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[162] Starling, *op. cit.*, 1920, pp. 225*ff*.

[163] P. Merz, "The Food Supply of Germany," *Manchester Guardian Commercial, Reconstruction in Europe*, Aug. 17, 1922, p. 359.

[164] L. G. Michael, *Agricultural Survey of Europe: Germany*, U. S. Department of Agriculture, Department Bulletin No. 1399, p. 79.

Conditions have been gradually returning to normal since the war both in the numbers of live stock and in the slaughter weight. In the case of calves, hogs, sheep and goats, the weight of the animals has returned to normal.[165] The price of live stock is still quite abnormal. On July 15, 1925, according to the Agent General for Reparations Payments, while wholesale prices in general stood at about 135 per cent of the pre-war level, the average price of three grades of beef cattle on the hoof stood at only 95 per cent. At the same time the wholesale price of the meat was 119 per cent and the retail price was 136 to 150 per cent of the comparable prices in 1913.[166] Such conditions cannot help but prove depressing to the industry. Whether or not the live-stock industry of Germany will soon recover its normal rate of increasing productivity is a matter for conjecture. It would seem as though the pre-war situation could be taken as a safer guide than the present disturbed condition in estimating the future of the industry. It must not be forgotten, however, that with the loss of territory the country has suffered the loss of some of her best farming lands. The separated provinces normally had a surplus of food for the rest of Germany. It is calculated that, on the basis of the pre-war animal population, 11.55 per cent of the cattle, 9.63 per cent of the sheep, 11.65 per cent of the pigs and 9.89 per cent of the goats have been lost.[167] At the same time over 10 per cent of the human population was lost under the Treaty of Versailles. Nevertheless, it has been calculated that at least 200,000,000 pounds of meats were shipped to the interior districts from what are now the lost provinces.[168]

In the pre-war days, the live-stock industry presented a

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[165] Wrenn, *op. cit.*

[166] *Report of the Agent General for Reparations Payments* (Nov. 30, 1925), p. 100.

[167] Merz, *loc. cit.*

[168] Michael, *op. cit.*

SUPPLY OF MEATS IN GERMANY, 1912 AND 1921-1924, IN THOUSANDS OF POUNDS

Classification of Meats	Former Territory, 1912	Present Boundaries, 1912	Republic of Germany			
			1921	1922	1923	1924
Home Produced						
Beef	2,114,377	1,833,456	1,455,047	1,518,672	932,400	1,561,167
Veal	392,772	331,131	274,451	281,406	227,500	345,376
Pig meat	4,605,310	3,968,159	2,328,708	2,326,834	2,022,100	2,896,869
Mutton	147,036	131,482	131,526	115,047	71,430	111,823
Goat meat	42,549	37,423	43,034	40,917	21,992	24,203
Horse meat	92,792	79,266	78,175	125,927	79,919	57,087
Chicken	161,763	141,006	116,502	176,368	128,175	128,175
Geese	103,429	88,074	84,921	108,025	83,113	83,113
Ducks	11,486	9,755	10,417	11,023	7,407	7,407
Other domestic stock and game	92,593	80,556	80,556	80,556	80,556	80,556
Fish	380,845	380,845	362,557	364,773	364,773	364,773
Total	8,144,952	7,081,153	4,965,894	5,149,548	4,019,365	5,660,549
Imported (Net)						
Beef and veal	83,753	144,500	67,627	112,326	182,648	235,605
Pig meat	43,652	167,619	223,695	98,214	142,716	143,947
Mutton	375	.....	3,371	3,564	2,856	2,444
Goat meat	22	5,780				

Horse meat	.....	.....	.....	.....	.....	.....
Chicken	19,489	23,120	44	—3	108	8,755
Geese	551	5,780	20		15	
Ducks	.....	.....	.....	.....	.....	.....
Other domestic stock and game	1,014	.....	45	1,431	130	1,207
Fish	785,830	658,918	698,651	324,848	510,239	668,386
Shell fish	.....	.....	—3,346	—15,200	2,878	29,930
Total (ex. shell fish)	934,686	1,005,717	993,453	540,380	838,712	1,060,344
Total Supply						
Beef and veal	2,590,902	2,309,087	1,797,125	1,912,404	1,342,548	2,142,148
Pig meat	4,648,962	4,135,778	2,552,403	2,425,048	2,164,816	3,040,816
Mutton	147,411	131,482	177,931	159,528	96,278	138,470
Goat meat	42,571	43,203				
Horse meat	92,792	79,266	78,175	125,927	79,919	57,087
Chicken	181,252	164,126	116,546	176,346	128,283	220,043
Geese	103,980	93,854	84,941	108,044	83,128	
Ducks	11,486	9,755	10,417	11,023	7,407	7,407
Other domestic stock and game	93,607	80,556	80,601	81,987	80,686	81,763
Fish (ex. shell fish)	1,166,675	1,039,763	1,061,208	689,621	875,012	1,033,159
Total (ex. shell fish)	9,079,638	8,086,870	5,959,347	5,689,928	4,858,077	6,720,893

marked contrast to that of Great Britain. It has already been noted that the expansion of this industry was not accomplished by turning plowland into grass but by the combination of animal husbandry with arable farming. Agriculture in Germany presents two other striking contrasts to that of Britain. The size of the farms is much smaller and labor conditions are very different.

Only 15.8 per cent of the farm land of England and Wales is in farms of less than 50 acres, while 48.5 per cent of Germany's farm land is in such small holdings. The typical farm in Germany is 12½ to 50 acres with 15.8 per cent of the land in still smaller holdings. The typical farm in England is 150 to 300 acres in size. In Germany 5.4 per cent of the farm land is in holdings of 5 acres or less.[169]

Agriculture in Germany was looked upon before the war as the best employment for a population ready for war. It was a national ideal to use as many people on the farm as could be "gainfully employed." In England the practice was to employ as few people on the farms as possible; those who were employed may not have received union wages, but they to a great extent enjoyed union hours and working conditions.[170] Wages in Germany were much lower and there were no restrictions upon the hours of labor. The greatest contrast comes in the persons employed per acre in the two countries. Not only are there more persons employed per acre, but the employment of women is very large. Great Britain employed only 5.8 persons per 100 acres on the average, while Germany employed 18.3 before the war. Of these 10 were women in Germany, while in England the employment of women was only 1.2. The proportion of those temporarily em-

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[169] Middleton, *op. cit.*, p. 12.

[170] "Is British Agriculture Worth While?" *The Round Table*, Vol. XIII, pp. 546-557.

ployed was also higher in Germany. It is on the small holdings that women were found most particularly.[171]

Probably the most striking contrast between the agriculture of Germany and that of other leading European countries has been the public attitude thereto. Agricultural products enjoy their full share of tariff protection in Germany. The effect of this protection on German agriculture has been debated lengthily. Apparently the amount of the tariffs has not been sufficiently high to produce the growth of agriculture without help from other causes. The tariff has, however, given the German farmer greater confidence in his work, and the public attitude expressed not only in the tariff but also in many other forms of official recognition has given the German farmer the feeling that he is recognized as a vital factor in his country's well-being and will receive as much protection as his safety requires; he will never be left to shift for himself. Agricultural education and research are also very far advanced in Germany and the result has been the adoption of technical improvements in larger measure than in other countries, notably France and England.[172]

Another very important factor in German agriculture is the extensive use of fertilizer. Artificial manures are not a rival to animal manure; they increase the productivity of the soil for both human food and animal fodder. The importation of fodder was also a very large source of fertilizer before the war, the nitrate so obtained almost equalling all the chemical nitrates used. The cutting off of the fertilizer both as chemicals and as imported feed has been one of the greatest causes of the decline of German agriculture since 1916.[173]

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[171] Middleton, *op. cit.*, p. 16.

[172] Middleton, *op. cit.*, pp. 23-27; C. Morel, "French Agriculture Since the War," *Manchester Guardian Commercial, Reconstruction in Europe*, Aug. 17, 1922, p. 358.

[173] Merz, *loc. cit.*

There is a closer alliance between the dairy and meat-producing industries in Germany than in Britain. Fat steer beef is not in a prominent position. Out of 903,100 tons of beef in pre-war years, 411,800 was cow beef and 143,800 was from the carcasses of bulls, while bullocks or steers furnished only 172,900 and heifers 174,600. Calves under three months furnished 172,600 tons, which is almost equal to the steer beef. More calves were slaughtered than mature cattle for beef. On the average 4,315,000 calves and 3,648,000 cattle were slaughtered in 1912-13.[174] Another striking proof of the relation between the dairy and meat production is seen in the consumption of milk by animals. The human consumption of "milk, cream, whey, etc.," is given as 11,813,800 metric tons, while the animal consumption of the same was 12,705,200.[175] It must not be assumed, however, that beef is merely a by-product of the dairy. Germany has a very important industry in the raising and fattening of beef of various classes.[176]

One of the outstanding features of German animal husbandry is the large number of pigs raised. The lack of imported grain has seriously affected this industry since the war. Pigs, goats and poultry are largely kept on the very small holdings. The density of the pig population on the smallest holdings of less than half a hectare is almost ten times as great as the average density for all farms. Pig keeping diminishes rapidly as the farms increase in size. These same facts are still more strikingly true for goats and poultry. Cattle, on the other hand, are more widely distributed and their greatest density is on somewhat larger holdings. Sheep predominate on either the very large or the very small holdings.

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[174] Eltzbacher, *op. cit.*, p. 57.

[175] R. Kuczynski and N. Zuntz, *Unsere bisherige und unsere künftige Ernährung im Kriege*, s. 2.

[176] Herter and Wilsdorf, *op. cit.*, pp. 123-194, 243-267; Eltzbacher, *op. cit.*, p. 139.

Cattle, hogs and sheep are by no means the sole source of meat in Germany. Horses supply about half as much meat as sheep. Geese are a very important item in the consumption. Other poultry exceeds even goose meat, and rabbits and game are estimated to make a substantial contribution.[177]

By far the larger part of the skim milk was fed to the pigs. Out of 22,451 million liters of cow's milk and 1,304 million liters of goat's milk, 5,000 million liters went to the pigs and 2,906 million liters were used for raising calves and kids.[178] The reduction of milk production has been seriously felt in the pig industry since the war disturbances.

Potatoes are raised very extensively for feeding live stock. The animal consumption of this food before the war was 22,030,400 tons compared with 13,996,700 tons used for human consumption. "Other roots and vegetables" were used still more freely, 73,691,800 tons of these appearing in the animal fodder. This latter is much larger than the hay consumption of 42,331,900 tons. A substantial part of the root consumption is beet pulp, a by-product of the sugar industry.[179] The war-time depression of the sugar industry also had a serious effect on the live-stock industry.

The German live-stock industry has depended heavily upon imported feeds. The Eltzbacher Committee estimated that nearly one half of the cow's milk and 24 per cent of the pork produced in Germany were due to imported fodder. This seems to be a purely arbitrary allocation of this imported feed; the pigs are assumed to have used imported barley and corn, amounting to about 2,925,602 tons, and the cows the other imported grain

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[177] Eltzbacher, *op. cit.*, p. 62.
[178] *Ibid.*, pp. 66, 181.
[179] Kuczynski and Zuntz, *op. cit.*

amounting to a net import of 4,376,712 tons. The chief imports imputed to cows were oil plants and oil seeds amounting to 1,587,891 tons, oil cakes, oil-cake meat, etc., to 811,369 tons and bran to 2,084,807 tons.[180] There is no reason to suppose but that much of the feed arbitrarily assigned by the Eltzbacher Committee to cows and pigs was in practice actually consumed by cattle and sheep being fattened, and by poultry. Such a distribution would, of course, reduce the proportion of milk and pork due to imported feeds and find its compensation in the production of the other meats. Since the cow and pig are the most efficient feed converters the rule followed by this committee would tend to minimize the effect of foreign fodder in German food production.

The Eltzbacher Committee found that in the two years before the war Germany obtained 44 per cent of the protein and 45 per cent of the calories in her animal foodstuffs from foreign countries either in the form of fodder, live animals or finished products.[181] It is impossible, owing to the arbitrary rule discussed above, to be sure how much of the meat and fat was due to foreign supplies of one sort or another. The table on page 271, adapted from their report, presents the situation as accurately as possible.[182]

Before the war the fresh pork imports came chiefly from Holland, Russia and Denmark, the first accounting for over 50 per cent and the last two together for about 40 per cent. In 1920 the supplies from these sources had disappeared and products from the United States formed 80 per cent of the trade. Since then supplies have reappeared to some extent from Holland and Denmark, and Jugo-Slavian pork is also appearing on the German market. American lard has always held the highest place

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[180] Eltzbacher, *op. cit.*, p. 70.
[181] *Ibid.*, p. 74.
[182] *Ibid.*, p. 62.

in the import trade in this product and is being maintained as far as Germany's purchasing ability permits. Salted and cured pork products, including bacon and ham, were not imported extensively in pre-war days, but trade in these products has assumed large proportions since the war, the United States being the chief source of supply.

CONSUMPTION OF MEAT AND FATS IN GERMANY, AVERAGE FOR 1912 AND 1913

Meats and Fats	Home Production	Net Imports				Consumption	Actual Nutriment, Billion Calories
		In the form of					
		Meat, Fat	Animals	Fodder	Total		
	In 1,000 tons						
Cattle	1,075.7	35.1	54.2	....	89.3	1,110.8	2,688
Pigs	2,026.3	20.9	12.3	585.1	618.3	2,047.2	9,417
Sheep, goats	78.5	0.4	....	....	0.4	78.9	259
Horses, dogs	40.3	....	1.1	....	1.1	40.3	55
Geese	47.1	0.2	30.0	....	30.2	47.3	218
Other poultry	85.7	8.6	13.0	....	21.6	94.3	122
Tame rabbits	15.0	....	....	....	....	15.0	26
Game	26.8	1.4	....	....	1.4	28.2	30
Meat extracts, juices, sausages	....*	—1.0	....	....	—1.0	—1.0	—2
Lard, etc.	....*	161.7	....	....	161.7	161.7	1,429
TOTAL	3,395.4	227.3	108.4	585.1	920.8	3,622.7	14,242

* Included under Meat.

The imports of beef before the war, as shown in the preceding table, amounted to about 35,100 tons in the form of carcasses and 54,200 tons in the form of live animals. These supplies came chiefly from neighboring countries, particularly Denmark. Holland and Sweden were also increasing their shipments.[183] Since the war, South

[183] Wrenn, *International Trade in Meat and Animal Fats*, U. S. Department of Commerce, Trade Promotion Series No. 26.

America and Australia have been the leading sources of outside supplies.[184] Imports of other meats and animals, except poultry, have always been relatively unimportant. The amounts of each class of net imports are shown in the tables on pages 264 and 265.

Austria

The old Austro-Hungarian Monarchy, as a whole, produced nearly enough meat for its own use. The pre-war average yearly foreign trade showed an import of 2,832,000 pounds of beef and veal, 5,537,000 pounds of tallow, 8,843,000 pounds of pork including lard, and 62,494 live cattle and calves. The exports were 1,056,000 pounds of beef and veal, 4,264,000 pounds of tallow, 3,034,000 pounds of pork including lard, 76,336 live cattle and calves and 25,692 sheep. The total exports of 10,132,000 pounds of meat and 104,095 live animals and imports of 17,441,000 pounds of meat and 74,546 live animals left a small balance in either direction compared with the domestic production.[185] The Empire was also a heavy producer of grain, making the region practically self-supporting in cereal products.

Within this wide area, however, a great amount of specialization had become established, based partially upon different natural economic advantages of various sections and partially upon Vienna's political and financial control over economic developments. Much of Austria proper and some parts of Hungary had become quite highly industrialized and traded the products of their factories with other parts of the Empire that were better suited to agricultural production. The trade developments of the last century had gone far toward making the whole territory

[184] *Foreign Crops and Markets*, U. S. Department of Agriculture, May 18, 1925, pp. 574, 576, 594.
[185] See pp. 576-583, *infra*.

truly a single community based upon a coördinated economic life. Territorial partitions, enforced by the treaty after the war, broke down the economic growth of generations and left the old community broken into various parts separated by customs, boundaries and bitter jealousies. Some parts have very real food deficits. Others have potential surpluses which can not readily be developed as in pre-war days on account of the difficulties involved in trading them for the potential industrial surpluses in the now separate parts of the old Empire. Needless to say, the development of the animal industry which was interrupted by the war has not yet been completely restored.

The new Republic of Austria is only about one-fourth the size of the old Empire and one-eighth that of the old Monarchy. The area that remains is the least productive agriculturally. As a result, farm production as it is organized cannot meet the food requirements of the nation in spite of the fact that about one half of the population is engaged in agriculture, forestry and kindred occupations.[186] Viewed in the light of mere statistics it might be supposed that the country could become self-sufficient, for it has only 198 persons per square mile while Germany had about 310 before the war and supported them all with the aid of net imports amounting to only 20 per cent of the food requirements. The percentage of those engaged in farming in Austria is also slightly higher than that in the United States.[187] The country is distinctly mountainous on the whole and the soil is comparatively poor. The climate is such that it is necessary to house the animals for six months of the year during which time they must

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[186] W. T. Layton and Charles Rist, *The Economic Situation of Austria,* Report to the League of Nations (1925), p. 61.

[187] L. G. Michael, *Agricultural Survey of Europe: the Danube Basin,* Part I, pp. 44-67.

be fed to a considerable extent on foreign fodder.[188] Moreover, the country is committed to the development of her industrial life and the sequel to such a program must be the net importation of foodstuffs.

Much has been done recently to abolish one of the greatest artificial handicaps to farm efficiency in the reorganization of land ownership. The land until recently was parceled out in the ancient "strip system" which split the country up into innumerable small strips too small to farm with any degree of efficiency. Those farmers who possessed any amount of land had many such strips scattered separately over the countryside. Recent government action is consolidating the holdings into more workable units, but the work is going all too slowly.[189] The government is also making other attempts to stimulate farm production.[190]

The Republic has only about 13 per cent of the human population of the old Monarchy on one-eighth of the area. The proportion of the live stock contained in this smaller area was about 14 per cent in the case of both cattle and pigs, 6 per cent in the case of sheep and 14 per cent of goats.[191] It is self-evident that only a rate of meat consumption higher than the average for the rest of the old Monarchy necessitated the large shipments formerly made into this area from other parts of the country. The animal industry of the land now in the Republic was and is more highly developed than the production of field crops. During the past few years a continued trend in this same direction has been noticeable. It is estimated that in 1923, the total value of the live-stock products was 1,040 million gold kronen as compared with a value of 142

[188] *Commerce Reports,* U. S. Department of Commerce, Jan. 8, 1923, p. 78.
[189] Layton and Rist, *op. cit.,* p. 65.
[190] Michael, *loc. cit.*
[191] *International Yearbook of Agricultural Statistics,* 1909-21.

million kronen for wine and fruit, 427 million for other crops in the previous harvest and 76 million for timber.[192] Comparisons between pre-war and postwar averages show a marked decrease in the acreage under cereals and a substantial increase in the area devoted to forage crops. To a certain extent this movement is probably transitory due to the unsettled economic conditions. However, the high upland pastures are especially suited to the development of stock raising and the experience of other sections of Europe indicates that emphasis upon this branch of agriculture tends to grow as the density of human population increases. The government plan for the future of the industry calls for the development of purebred stock in the western part of the country for export to the neighboring countries to the south and east. It also calls for an increase in the total number of stock until the feed possibilities of the country are reached. It is estimated that this would give 2,700,000 cattle, 1,200,000 calves, 350,000 horses, 2,700,000 swine, 660,000 sheep and goats and 8,000,000 fowls.[193] This is a moderate increase over the numbers in either 1910 or 1920, which appear in the following table.[194] Nevertheless, if Austria develops as other countries have, we may anticipate a live-stock population greater than what would be supported on domestic fodder alone. The country is admirably situated for the import of feeding stuffs and the future may easily see an expansion of the animal industry related more to the domestic demands for products than to the capacity of the soil to produce feeding stuffs. Before the war the district of Burgenland, which has been added from old Hungary, did import relatively large quantities of corn for fattening

[192] A. Basch and J. Dvorocek, *Austria and Its Economic Existence*, p. 19.

[193] Michael, *op. cit.*

[194] *Ibid.; International Yearbook of Agricultural Statistics*, 1924-25, pp. 200-212.

both steers and swine. As trade in Central Europe becomes less subject to restrictions such practices will, doubtless, increase.

LIVE STOCK IN AUSTRIA

Stock	1910	1920	1923
Horses	318,652	252,257	282,651
Cattle	2,355,878	2,319,955	2,162,385
Cows	1,172,697	1,037,755	.....
Young stock.	401,804	564,976	.....
Swine	1,932,268	1,354,202	1,473,219
Sheep	300,783	452,475	597,413
Goats	239,147	322,203	382,146

It is unlikely that any of the statistics for recent years are very accurate. The peasants learned to conceal the true number of their stock during the years of requisitioning for the army and it is improbable that the actual numbers are reported now. The gain manifested in the number of young stock speaks very well for the future. The loss in pigs, if not already made up in fact, will doubtless soon disappear.

The Austrian government has estimated that before the war the consumption was 146 pounds of meat and 33 pounds of cooking fat per capita. During the war this decreased to 110 and 22 pounds respectively. For the years 1919 to 1921 the amounts decreased still further to 66 pounds of meat and 13 pounds of fat. The government hopes to keep these amounts well below the pre-war levels. Economic necessity will probably enforce this plan for a time, but the Austrian workmen, like those in other countries, manifest a demand for more rather than less meat.[195] The consumption was still below the pre-war levels in 1924.[196]

[195] Michael, *op. cit.*
[196] *Foreign Crops and Markets,* April 13, 1925, pp. 406, 435.

Some idea of the relative importance of the different classes of meat in the diet may be gathered from the following table showing the fresh meat supply in Vienna in 1923 and 1924.[197] No account of cured meats of foreign origin appears in these statistics. Nevertheless, the foreign supplies of fresh meats are large. The increased supply of foreign hogs, largely from Poland, is very striking.

MEAT SUPPLY IN VIENNA

Live Stock and Carcasses	Domestic		Imported		Total Supply	
	1923	1924	1923	1924	1923	1924
Cattle	70,681	40,562	132,732	126,126	194,403	166,688
Calves	137,013	124,108	486	2,686	137,499	126,794
Lambs	4,246	5,780	179	679	4,425	6,459
Sheep	29,206	14,961	2,909	881	32,115	15,842
Hogs, meat	79,028	65,162	37,879	318,855	116,916	384,017
Hogs, fat	8,103	5,673	109,044	128,840	117,236	134,513
Goats	2,854	2,025	.....	7	2,854	2,032
Kids	16,915	21,255	.....	23	16,915	21,278

Before the war only 46 per cent of the meat and 30 per cent of the fat consumed in the whole country were produced in what is now Austria. Hungary produced 73 per cent of Vienna's meat supply.[198] During the war the decrease in consumption allowed a slight increase in the percentages of home-produced meats and fats. The period immediately after the war saw such small imports that the domestic production supplied 63 per cent of the meat and 84 per cent of what fat was eaten.[199] The postwar foreign supplies for a time came partially from the United States. Western European countries have helped to supply the deficit.[200] As conditions become more settled in

[197] *Ibid.*
[198] *Commerce Reports, loc. cit.*
[199] Michael, *op. cit.*
[200] *Commerce Reports, loc. cit.*

Central Europe the other Danubian countries can be expected to become again the chief source of foreign supplies, but home production should become relatively more important.

Hungary

Hungary, as it stands to-day, is less than one-third of the area of the old Kingdom. Burgenland, a small strip on the west, was given to Austria. Croatia-Slavonia and Voivodina went to Yugoslavia. Transylvania is now part of Roumania, and Slovakia and Ruthenia are in Czecho-Slovakia. The part that remains has a population of 8,000,000 as compared to about 21,000,000 in the pre-war Hungary. It also is more densely settled, having 215 persons per square mile against 166 in the larger area. The outlying regions which have been lost, were heavily timbered, 26.2 per cent of the lands being in forest. The present Hungary has only about 12 per cent in forests and consists largely of treeless river plains and rolling hills, 93.8 per cent of which are classed as productive.

The old Kingdom was distinctly a surplus-producer of foodstuffs. In the average normal year, 1911 to 1915 inclusive, nearly 40 million bushels of wheat appeared in the net exports. The present Hungary was the leading source of the surplus. Of rye there was a net export of nearly 11 million bushels and most of this originated within the present boundaries. Corn to the amount of nearly 7 million bushels went as a surplus, but in this grain the present area of Hungary was little more than self-sufficient. In barley and oats also the present area took the lead in substantial net exports. Potatoes and sugar beets were raised in excess of local requirements in both the larger and narrower areas. Cattle, sheep and swine, were also exported alive in fairly large numbers, chiefly to Austria. The average cattle shipments were 258,112. Sheep number-

ing 18,636 and pigs numbering 603,266 were exported.[201] There was also a substantial export of meats. The Hungarian statistical yearbook shows an export for 1912 of "animal products" amounting to 277,042,815 pounds and an import of 50,890,220 pounds, making a net export of 226,142,595 pounds. In addition there was an export of 84,181,828 pounds of fat against an import of 68,579,248 pounds, making a net export of 15,602,580 pounds of fat. The total net export of fats and other animal products in the year 1912 was 241,745,175 pounds.[202]

The export of animals and their products in the years before the war was more important than that of cereals and flour. The increase in the importance of this trade in the generation before the war may be seen from the following table showing the value of cattle and their products exported:[203]

Exports of Cattle and Products from Hungary

Date	Value
1881	$ 4,550,000
1894	72,760,000
1904	143,650,000
1912	150,180,000

It is thus evident that old Hungary was a very real surplus-producer of feedstuffs, live stock and animal products. The smaller part, which is now Hungary, in spite of its greater density of population was certainly one of the leading surplus regions for grain and apparently also for live stock and meats. Statistics available on slaughterings in the old Kingdom show much heavier slaughtering in

[201] Michael, *Agricultural Survey of Europe: The Danube Basin*, Part I, U. S. Department of Agriculture, pp. 7-38.

[202] *Annuaire statistique hongrois*, 1912, p. 222.

[203] J. Bekessy, "The Present Condition of Cattle Breeding in Hungary," *Monthly Bulletin of Agricultural Intelligence and Plant Disease*, 1915, pp. 7-13.

proportion to the human population for the older part known as Hungary proper than for what was then the newer part or Croatia-Slavonia.[204] This, of course, is not certain proof of the greater productivity of the animals actually raised even in that larger area. Data on the density of the animal population show a fairly even distribution of cattle throughout the old Kingdom, with the greatest density in what is now Czecho-Slovakia and a density somewhat above the average in new Hungary. In the old Kingdom there were 220.1 cattle per 1,000 hectares and in 1921, even with the reduced herds, there were 223.5 to the hectare in the new Hungary, while in Czecho-Slovakia there were 299.8. The number of sheep increased distinctly per unit of area, from north to south in the old Kingdom. The land now known as Hungary had a somewhat greater than average density of sheep population. In the case of swine the center of the old industry was distinctly in the "corn belt" which includes the limited area of the new country as well as part of Croatia-Slavonia. Even with the falling off in this industry in recent years, the data for 1921 showed that the new Hungary has twice as many pigs to the square mile as the old Kingdom had supported.[205]

The native cattle of Hungary were formerly bred chiefly for their value as work oxen. They matured late and could be worked to a ripe old age, but they were poor milk producers and only indifferent in the production of meat. Only within recent decades were these latter qualifications of any particular importance, for meat and milk were not popular articles of diet and formed but a small part of the food of the peasants and industrial workmen. In the years before the war economic developments forced a change in

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[204] *Annuaire statistique hongrois*, 1912, p. 140.

[205] *Annuaire international de statistique agricole*, 1909-21, pp. 237-246.

the cattle. Meat was in real demand and a more intensive animal industry was found to be an essential part of profitable farming operation. Accordingly, under the leadership of the large landowners and the government, new breeding stock was introduced. The new stock introduced was largely dual-purpose breeds from Switzerland and the Tyrol. The center of the new industry was in the western part of the old Kingdom whence it spread over the country. During the two decades before the war the numbers of cattle increased materially. The increase, however, failed to keep pace with the population growth owing to the greatly increased domestic and foreign demand for the meat. As a matter of fact, the numbers of breeding stock did increase faster than the human population, but not quite rapidly enough to offset the demand. The increase in the numbers of cattle and other live stock during this period appears in the following table.[206]

INCREASE OF LIVE STOCK IN OLD HUNGARY

Year	Cattle			Buffaloes	Sheep *	Swine *
	Native	Imported Breed	Total			
1884...	3,819,898	939,495	4,759,393	119,645	11,180,841	5,554,130
1895...	3,756,137	1,940,303	5,696,440	132,578	8,122,682	7,330,343
1904...	.....	.....	.....	.....	8,211,420	5,440,000
1911...	1,872,790	4,154,442	6,027,232	155,192	8,548,204	7,580,446

* Including Croatia-Slavonia.

During the war and in the unsettled periods thereafter the numbers of live stock decreased. Agriculture in general has been experiencing a marked depression and the animal industry has shared in the crisis. The reduction in the numbers of sheep is particularly striking, for the gen-

[206] Holmes, *Meat Situation in the United States*, U. S. Department of Agriculture, Report No. 109, p. 195; Bekessy, *op. cit.*

eral trend for these animals has been downwards even when other animals were increasing. The statistical record of the changes in the area covered by new Hungary over the war period and recent years is shown in the following table:[207]

NUMBER OF LIVE STOCK IN HUNGARY BEFORE AND AFTER THE WAR

Stock	1911	1920	1924	1925
Cattle ...	2,194,474	1,940,516	1,896,041	1,920,000
Sheep ...	2,299,463	1,339,389	1,814,155	1,890,000
Swine ...	3,191,868	2,652,744	2,458,006	2,482,000

The buffalo appears even in new Hungary, but its importance in the old Kingdom grew toward the east. In Transylvania, now part of Roumania, it is an important element of the live stock.[208]

The hogs are bred mainly in the Corn Belt which extends through the heart of new Hungary and south into Yugoslavia, although this animal is fairly important all over the country. The pigs are also more important on the peasant farms than on the large estates. Over 80 per cent of the swine in old Hungary belonged to the Mangalica breed, which is distinctly a lard hog. In recent years before the war, Yorkshires were being imported to form the basis of a lean-bacon industry.

Sheep are raised on the estates on the plains of Hungary for wool and to a certain extent for meat. The peasants raise a native breed for milk and for the production of the fur known as "Persian lamb."

Some idea of the relative importance of various classes of meat in the diet may be gathered from the following

[207] *Foreign Crops and Markets*, Aug. 22, 1923, p. 156; *International Yearbook of Agricultural Statistics*, 1924-25, pp. 200-212; *Foreign Notes on Meats, Fats, Oils and Livestock*, U. S. Department of Commerce, Feb. 19, 1926, p. 7.

[208] Michael, *op. cit.*

table which gives the slaughtering, in public abattoirs in Hungary, exclusive of Croatia-Slavonia in 1912:[209]

SLAUGHTERINGS IN PUBLIC ABATTOIRS IN HUNGARY

Numbers of Animals

Bulls	32,161
Oxen	141,503
Cows	283
Heifers and Steers	169,639
Calves	554,189
Buffaloes	6,463
Sheep	808,991
Lambs	597,531
Goats	31,714
Kids	32,193
Swine	1,564,517

When the effects of the war and all the disturbances which came in its wake have disappeared, a rejuvenation of the live-stock industry may be expected. However, very much remains to be done in the field of agricultural education to bring the peasant standards of production up to a more efficient plane. Disturbances of trade that formerly was domestic and now is foreign, circumscribed by customs restrictions and export prohibitions, have done much to depress production. Within a few years these evils must certainly be mitigated and permit of the return of an increasing rate of animal production.

CZECHO-SLOVAKIA

THE Republic of Czecho-Slovakia was established on October 28, 1918, by declaration of independence from Austro-Hungary. The western portion inhabited by the Czechs, *i. e.*, Bohemia, Moravia and Silesia, had formerly been a part of the territory of Austria, with the exception of a small slice added from German Silesia. In this part

[209] *Annuaire statistique hongrois,* 1912, p. 140.

of the country there is a fairly dense population; each of the provinces has more than 300 persons per square mile.[210] Literacy and general intelligence are also high. While agriculture is well developed in this section it is more or less overshadowed by industrial production and only 31 per cent of the population are engaged in agriculture. The remaining parts of the nation came from the old Kingdom of Hungary. These provinces, Slovakia and Carpathian Ruthenia, present many contrasts to the western section. Agriculture predominates, but in many ways is not so highly advanced as in the Czech section. Sixty-two per cent of the population are engaged in agriculture and there is little industrial development, except for mining and forestry in Ruthenia.[211] Illiteracy is comparatively high and the farmers are slow to change their methods. The population density is only 117 per square mile in Slovakia and 107 in Ruthenia. In the Czech country it is said that agriculture is grounded upon "science with practice," while the eastern section is the land of farming by "custom and habit."[212] These two diverse regions have been joined together in the Republic and it is hoped that the differences will make a more complete and self-sufficient community, the industrial and agricultural sections affording markets for each other's wares and the diverse social elements affording a mutual balance.[213] Unfortunately, the artificial as well as the natural channels of communication run from north to south, whereas the shape of the country as well as its differences of economic development call for commerce between east and west.

The physical geography of the country presents moun-

[210] Michael, *Agricultural Survey of Europe: The Danube Basin*, p. 68.

[211] Vlad. Brdlik, "The Origin of the Republic and the Mission of Agriculture in Czechoslovakia," *World Agriculture*, October, 1924, pp. 335-342.

[212] Michael, *op. cit.*, p. 85.

[213] Brdlik, *op. cit.*

tain ranges almost enclosing the country on the west, north and east, and partially on the south. These higher lands are classed as the region of forage crops and pastures. The center of the country is much lower and is utilized for growing grain on the regions of minor elevation and sugar beet on the lower plains. These are the regions of intensive animal husbandry, while the highlands are more devoted to the extensive side of the industry.[214] The climate in no section is particularly warm, for the latitude corresponds to that of Winnipeg, in Canada; but corn is raised to a limited extent.

Agricultural production per unit of area is more highly developed in the Czech provinces of the west. This region had a surplus of barley and rye, but a deficit of wheat. No complete data are available as to live stock and meat movements in normal times, but the numbers of cattle per unit of area are slightly greater than in Germany. Slovakia has had, and still has, a surplus of even wheat and rye, but Ruthenia has a deficit of grain. These sections have more cattle in ratio to the human population than Hungary does and apparently have a real surplus of cattle products. Czecho-Slovakia as a whole is normally able to make net exports of either cattle or beef and mutton and lamb, but is far from being self-supporting as yet in pork and lard. The international reputation of Prague hams may also be expected to perpetuate a certain amount of export of pork products.[215] It is roughly estimated that a swine population of 5,000,000 will be needed, instead of the 1,437,050 reported in 1920, to make the country self-supporting in pork products.[216]

During these last two years the country has been on distinctly a net import basis. Cattle and hogs are imported

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[214] *Ibid.*

[215] Dr. Fr. Tumlir, "The Czechoslovak Animal Industry," *World Agriculture*, October, 1924, p. 349.

[216] Michael, *op. cit.*, p. 79.

heavily from Poland. In 1924, 2,191,372 pounds and in 1925, 3,703,728 pounds of ham were exported. On the other hand were imports as shown in the following table.[217]

IMPORTS OF ANIMALS AND MEAT IN CZECHO-SLOVAKIA
1924 AND 1925

Year	Pigs, Number	Cattle, Number	Fresh and Frozen Meat, Pounds	Lard and Bacon, Pounds
1924.....	228,594	190,448	22,017,340	83,159,717
1925.....	403,605	168,411	26,774,867	127,406,038

The foreign trade is greatly hampered by tariff boundaries and trade restrictions.

During the war and in the unsettled days immediately after the revolution, all agriculture suffered a great depression. It is estimated that this depression cut down the production by 40 per cent.[218] Live stock as well as crops were affected. The policy of splitting up the large estates for small farmers apparently helped in a small measure to cut down the production for a time, although eventually it will probably have a slightly stimulating effect upon the live-stock industry. Agriculture also suffered from the drastic fall in prices which occurred when the rate of foreign exchange rose rapidly in 1922. The live-stock industry has by now almost, if not completely, recovered its pre-war position.[219] The following table gives the best available statistics of the changes in the numbers of animals in the Czech provinces, but the more recent figures are probably too low even for the times indicated.[220]

[217] *Foreign Notes on Meats, Fats, Oils and Livestock,* U. S. Department of Commerce, March 26, 1926, p. 8.
[218] Brdlik, *loc. cit.*
[219] Michael, *op. cit.,* pp. 79, 83, 86.
[220] *Ibid.,* p. 79.

LIVE STOCK IN CZECH PROVINCES

Date	Cattle	Swine	Sheep	Goats
Dec. 31, 1910	3,288,291	1,790,545	182,863	649,615
April, 1918..	2,511,869	543,393	147,111	752,519
Dec. 31, 1920	3,043,091	1,437,050	217,357	.....

It is very evident that, even though the rate of recovery may have slackened since 1920, the probabilities are that the present numbers of cattle and swine are equal to the pre-war. The sheep and goats in 1920 were admitted to be greater than the pre-war figures. Unfortunately, the peasants have not yet recovered from the lessons which they learned when the military requisitions took their animals from them and accurate statistics are hard to get. No real data exist for the changes in the numbers of animals in the eastern provinces. There is some reason to believe that in Ruthenia the numbers of animals are considerably greater than before the war.[221] An examination of the data available on changes in cultivated areas shows that cereal acreages have decreased since pre-war days, while forage plants, meadows and pastures have increased. The increase in clover production is particularly noteworthy.[222]

It is estimated that 60 per cent of the annual field harvest is fed to animals. Large supplies of grain as well as forage are available for feeding. Corn is not raised to any great extent, but barley takes its place to a large degree.[223] The sugar-beet industry on the lowland plains also affords excellent feed. The leaves, stalks and pulp from the beets are said to yield as much feed per acre as a by-product as would come from an acre of clover. The distillery waste from potatoes as well as grain also supplies

[221] *Ibid.*, p. 91.
[222] *Ibid.*, pp. 70, 78-79.
[223] *Ibid.*, p. 20.

important forage. A regular fattening industry is carried on with the use of such wastes, the feeder stock being provided from the small farms and the rough mountain regions.[224]

Improved breeds of cattle are driving out the older breeds which are chiefly work animals. In the Czech provinces the newer type founded on a cross with Swiss cattle is predominant. Toward the east the native cattle became more important. In Slovakia, 84 per cent are Swiss, while in Ruthenia only 16 per cent belong to this newer breed.[225]

The old native hogs, which are of the fat type, are being improved by the introduction of Yorkshire blood. This development has gone farthest in the Czech provinces, but has made appreciable progress in Slovakia. In Ruthenia, 93 per cent is still the old native stock.[226]

Sheep are raised chiefly in Slovakia and are regarded primarily as milk animals.

The recent development of the animal industry has received some slight impetus from the break-up of the latifundia and increase of smaller farms. Animal husbandry is more important and intensive on the small and moderate-sized farms.[227] This influence must not be overemphasized, however, for the area in large estates was never very great. Four-fifths of the farming land is "cultivated after the manner of family holdings."[228] Perhaps a greater economic reason for the comparative growth of the live-stock industry is that Czecho-Slovakia is an inland country with only fair means of communication with the outside world, and only those farm products, such as meats, which are

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[224] Brdlik, *loc. cit.*

[225] Michael, *op. cit.*, p. 32; Tumlir, "The Czechoslovak Animal Industry," *World Agriculture*, October, 1924, p. 349.

[226] Tumlir, *loc. cit.*; Michael, *op cit.*, p. 34.

[227] *Ibid.*, p. 83, 86.

[228] Brdlik, *loc. cit.*

relatively valuable for their weight, can be exported profitably.

Yugoslavia

Yugoslavia, or the Kingdom of the Serbs, Croats and Slovenes, was formed at the close of the war by a union of the southern sections of the Austro-Hungarian Empire with Serbia and Montenegro. The resulting nation appears to be fairly homogeneous in race, but includes lands differing widely in economic development.

It can scarcely be said that a new economic community has yet been established. The results of the war and later adjustments, including the so-called agrarian revolution, have left agriculture in such an abnormal state that recent data are not very instructive nor are they reliable. To comprehend the capabilities of the live-stock industries of the country it will be necessary to present some facts regarding the various countries now combined in this new nation.

In no part of the Kingdom is there any great degree of density of human population. Voivodina on the northeast has 181 persons to the square mile. Slovenia has 174 and Croatia-Slavonia has 160. However, in none of these districts is there any particular industrial development. The comparative density is due to a fairly intensive agriculture. In Montenegro, on the other hand, there are only 54 persons to the square mile and south Serbia and Bosnia-Herzegovina have less than 100. The physical characteristics of the country also are greatly varied. Some sections, particularly those most lightly populated, are mountainous, while others are very fertile plains.

Slovenia is a mountainous section taken mostly from Austria and partially from Hungary. It is not a good grain country. The greater part is in forest and there is some pasture land and meadows. Since the war the corn

acreage has increased, indicating an expansion of the swine industry, for corn is not used much for human consumption. The numbers of cattle and pigs per unit of area are fairly high, but the sheep and goats are not as numerous as in other sections of the new nation, particularly in the south.

Croatia-Slavonia is a large section reaching well into the Danubian plains on the east and to the mountains bordering the Adriatic on the west. Ninety-five per cent of the land is classed as productive, but mountains and swamps cut down the degree of productivity in many parts. The mountainous regions are used chiefly for forests and pasturage and in recent years systematic efforts have been devoted to the introduction of clover and good grasses to aid the dairy industry. There are large herds of swine in the oak and beech forests on the hills. Sheep and goats are not raised to any great extent. Corn is the leading grain raised in the farming regions and its production has increased with the breaking up of the large estates since the war. The corn is fed to the live stock in addition to their other forage. The production of wheat and rye is insufficient for the local needs, but live stock, particularly pigs and horses, were shipped out of the district in prewar days.

Voivodina is in the lower part of the upper Danube Valley just above the "Iron Gate." This is the richest grain district of Yugoslavia. Wheat and corn are grown in abundance. Hogs are found there in the greatest density of any of the sections of the country. They were raised mostly by small farmers, and the land reforms have broken up the large estates and left more opportunity for pig raising. The number of cattle is not very large, nor are there nearly as many sheep as in the south. There are almost no goats.

Bosnia and Herzegovina together form one district south

of Croatia-Slavonia and directly west of Serbia. The district is largely mountainous with twice as much forest as plowland. The area in pasture and meadow formerly was greater than that plowed. It depended upon other sections of the country for a portion of its grain supply, although cattle were found among the chief exports. Before the war about one-third of the arable land and a large part of the meadow and forest were still held in feudal tenure and the common peasants were hereditary or contractual serfs. The agricultural revolution set these free and supplied them with land taken from the landowners with a certain amount of compensation. Apparently this move is increasing the comparative production of corn and live stock. Cattle raising is fairly important throughout the whole district and pig raising is important in the valley of the Save in the north. Sheep raising is very much more important than in the northern districts. Agriculture in general, however, may be described as backward, and antiquated in its methods.

Dalmatia is a small strip of coastland between Bosnia and the Adriatic. It is largely mountainous and only 11 per cent of the area is under cultivation. The remaining portions, except for purely sterile sections, are mountain pasture and meadow. Contrary to the general rule in this part of the world, the mountains are not covered with forests. In the days of the building of ships in Venice, the old forests were cut for shipbuilding and the pirates burned much of the rest. It is said that the goats have kept the trees from growing again. Certainly the goats are numerous. Sheep also are numerous and, with the goats, are said to afford practically the sole animal food of the peasants. Cattle raising is not as important here as in some districts. However, it is one of the most important industries that do exist. The post-war agricultural revolution means little here, for the reform of land tenure

had already been accomplished in large measure and but few latifundia existed to be distributed in 1921.[229]

Montenegro is a small, sparsely settled district between Serbia and the Adriatic. In the north are massive mountains. Along the sea and the chief river valleys are well-watered plains not unlike Lombardy. Between these plains and the high mountains are rocky hill regions. Agriculture is backward and the country never produces enough grain for its own use. Stock raising is an important means of livelihood. Goats and sheep are kept on the high pastures and swine are herded in the beech forests. On the lower slopes there are cattle belonging to a small native breed. The change of land ownership since the war has been extensive, but of little practical effect, for the former serfs merely utilize the same land in the same old way they have for generations, although they are now free landowners.

Old Serbia on the whole is a mountainous country. There are mountain ranges on the frontiers, excepting in the north, and isolated mountains are scattered over the country. These mountains are covered for the most part with forests of beech and oak where large herds of swine fatten in the summer and autumn, returning to the lowlands in winter. Corn also is raised to a certain extent for feed. Almost twice as much corn is raised as wheat. The corn crop, however, is human food as well as animal feed and in seasons of shortage the animals go without it. The swine are the most important animals and their export is one of the chief branches of commerce. Sheep are also raised extensively and only Bulgaria and Greece among the European countries surpass this district in the ratio of the number of sheep to the human population.[230] Cattle

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[229] Michael, *Agricultural Survey of Europe: The Danube Basin*, Part I, U. S. Department of Agriculture, Bulletin No. 1234.

[230] *Annuaire international de statistique agricole*, 1909-21, p. 240.

also are fairly important, being bred for work and export, and have been on the increase since before the war. Buffaloes appear in the south. There was no opportunity here for an agrarian revolution, for there were no large estates and the peasants were in actual possession of the land. The postwar agricultural depression seems also to have been less severe here than in some other sections of this country.

South Serbia was under Turkey until 1913, and its inhabitants, while Serbs, are Mohammedans. The religious objections to the swine seem to have been absorbed from their former rulers, for there are far fewer pigs per square mile and per person than in old Serbia. Goats are considerably more numerous, but cattle and sheep are less important.[231] In contrast to conditions in old Serbia, the peasants were serfs until 1919. Freedom will not mean any change in occupancy of the land, but eventually it will probably stimulate greater activity in agriculture and animal husbandry.

It has already been noted that the statistics for this nation are not very reliable. In some parts there has been practically no attempt to gather accurate statistics until recently. The recent disorganization of the whole life of the country has made the available data less dependable than they otherwise would be. All the indications are that the grain production of the country has decreased so much that there is not sufficient for the proper nourishment of all the people, although some sections are now exporting grain. Eventually there will be an important cereal surplus in the nation. The tendency in general is to restore the numbers of live stock rather more rapidly than the grain production. The following estimate has been made of the numbers of live stock in 1921:

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[231] Michael, *op. cit.*

LIVE-STOCK ESTIMATE FOR 1921 IN YUGOSLAVIA

Cattle	Buffaloes	Swine	Sheep	Goats	Fowls
4,960,000	52,000	3,373,000	7,011,000	1,553,000	15,076,000

Yugoslavia is the best fitted by nature of any of the European countries to compete with the United States in the production of hogs. She possesses exceptional forage and climatic advantages. At present the backwardness of the population is a very real obstacle to progress in this or any other industry. Trade restrictions are also a very powerful handicap at present.[232] Eventually it may be expected that this country will be really developed. It will then be a leader in the world's meat industry.

ROUMANIA

Roumania was greatly augmented territorially at the end of the war. Transylvania was acquired at the expense of Hungary and Bessarabia from Russia. The area and the numbers of inhabitants have been more than doubled. The average density of population has also been increased.

Agriculture and animal husbandry are very important in Roumania. In proportion to its area the country is one of the world's richest agricultural countries, with a combination of soil and climate similar to that of the northern half of the United States. Much remains as yet in the process of modernization before the production can reach its proper development. Of the country's total area approximately 43.1 per cent is arable, 7 per cent meadow, 9.3 per cent pasture, 1 per cent vineyards and orchards, 23.5 per cent forests and 16.1 per cent nonagricultural lands.[233]

[232] *Commerce Reports*, Dec. 25, 1922, p. 772.
[233] *Roumania, an Economic Handbook*, U. S. Department of Commerce, p. 87.

The disturbances arising out of the war and the later agrarian revolution have been so far-reaching that less wheat was raised on the whole area in 1920-22 than on the smaller area in 1911-15. Corn production has increased, but not in proportion to the area. The production of oats and barley, however, did not decline per unit of area.[234]

The latest available statistics show that in 1924 the cattle numbered 5,398,704, the sheep 13,611,902, the goats 531,-236 and the hogs 3,133,144.[235] These figures show a substantial increase over the year 1920. The data for 1920 showed that in ratio to total area the pigs and goats had increased, while the cattle and sheep had decreased with the expansion of territory and the war-time disturbances in the whole live-stock industry.[236] What part of these changes was due to fundamental differences in the acquired territories and what to local disturbances within each area is difficult to determine. Goats are unimportant in Roumania. Sheep are relatively more important there than farther north and west in Central Europe, but much less important than in the Balkans. Pigs are fairly important, but it may be given as a general truth that the pig decreases steadily in relative importance in Central Europe from the northwest to the southeast, and the density of the pig population is less than in the upper Danube Basin. Cattle are fully as important in Roumania as in the average district in this part of the world.[237] Buffaloes appear here and form 6.78 per cent of the cattle in Transylvania. Very evidently the war caused a great diminution in the

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[234] G. Jonescu-Sisesti, "The Danube Countries as Food Sources," *The Manchester Guardian Commercial, European Reconstruction,* Sec. XIV, p. 831.

[235] *International Yearbook of Agricultural Statistics,* 1924-25, pp. 200-212.

[236] *Annuaire international de statistique agricole,* 1909-21, pp. 237-248.

[237] Finch and Baker, *Geography of the World's Agriculture,* pp. 123-144.

number of the stock per unit of area, but the more recent tendency is clearly to increase the live stock rather than the production of bread grains for export,[238] although there was a recession in the numbers of life stock in this country in 1925.

Probably the greatest cause of this tendency to develop live stock rather than the production of bread grains is the agrarian revolution which has assumed large proportions in Roumania. In the middle of the last century the peasants were set free from serfdom in all the districts now in the nation. At that time they received about one-third of the land then under cultivation. From time to time various steps were taken to meet the "land hunger" of the peasants, but the final steps were taken at the end of the war, at which time fully one half of the country was in the hands of a few thousand landowners. Most of these large estates have been expropriated with some compensation and turned over to the peasants. Such a revolution in ownership must of necessity produce a temporary disturbance even though much of the area formerly in the large estates was farmed by the peasants on the share or money-rental basis.[239] The production of wheat and oil-yielding seeds for export was formerly carried on by the large landowners. As a consequence of the revolution this production has decreased strikingly.[240] Whether or not it will recover eventually is a grave question. On the other hand, these landed proprietors owned only one-tenth of the live stock of the country. The peasants were distinctly the stock breeders and now that they have the land they are developing this branch of agriculture at the expense of the

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[238] Jonescu-Sisesti, *loc. cit.*

[239] Jonescu-Sisesti, "Land Reform in Roumania," *Manchester Guardian Commercial, Reconstruction in Europe,* Sec. VI, pp. 373, 374.

[240] Prof. Max Sering, "Economic Consequences of the Agrarian Revolution in Central and Eastern Europe," *Manchester Guardian Commercial, Reconstruction in Europe,* Sec. VI, p. 368.

growing of cereals for export. Authorities differ on the question of the other effects of what are called locally the "land reform" measures. The opinion seems to be unanimous on the effect on the comparative development of the animal industry and cereal growing.

Eventually production may be expected to increase in Roumania. Agricultural methods are still primitive and much public work remains to be done in developing the best types of use of the Danube Valley, a large part of which is subject to floods. An enormous area of nearly two and one half million acres is subject to flooding at the maximum. This has produced a very fertile soil which is exceedingly valuable for agriculture when it is free of water. Dikes and other means of water control must eventually be developed. When the floods are made subject to intelligent human control this area will be greatly improved in value for agriculture and animal industry, although the production of fish will probably continue to be an important factor in the economic life of this district.[241]

Bulgaria

Bulgaria is one country in the Balkans that has suffered comparatively little change of boundary since pre-war days, although Macedonia was taken by Greece in 1913. It is partially a mountainous country. The eastern end is a highland region. The Balkan mountain range proper runs through its center from east to west and another range extends along the southern boundary. The Danube forms its northern boundary and the country includes part of this river valley. The Maritza River flows through the southern portion which is Eastern Rumelia, making another valley in this section.

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[241] Dr. Gr. Antipa, "The Economic Value of the Lower Danube Valley and the Supply of Food," *Manchester Guardian Commercial, Reconstruction in Europe,* Sec. VI, pp. 363-365.

Agriculture and stock raising are the main sources of wealth, but farming methods are exceedingly crude and primitive. Conservatism and fear retard progress among the peasants, although the government has tried to improve farming methods. The postwar government has adopted drastic schemes to compel labor and to provide the peasants with land.[242]

The country produces a surplus of agricultural products and normally exports both grain and live stock. There has been a moderate decrease in the production of wheat and rye since the war and the corn crop has been decidedly below the normal.[243] The cereal exports are much below the pre-war level. The number of cattle decreased very little during the war. Cattle breeding however is not very important. The animals are kept largely for draft purposes. Buffaloes and camels are also used to some extent for working. The number of pigs is not very great, but sheep and goats are very numerous. Bulgaria has more goats per square mile and per inhabitant than any other country in Europe with the exception of Greece. The sheep are very numerous. The statistics for pre-war days show practically two sheep for every human inhabitant. In relation to both acreage and human inhabitants, Bulgaria has more sheep than any other country on the Continent.[244]

The live-stock census of 1920 showed 1,877,000 cattle, 418,000 buffaloes, 1,090,000 pigs, 8,923,000 sheep and 1,332,000 goats.

The following table shows the numbers and dressed

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[242] Alex. Stambolisky, "The New Bulgaria and Compulsory Labour," *Manchester Guardian Commercial, Reconstruction in Europe*, Sec. VI, pp. 370, 371.

[243] *Commerce Yearbook*, U. S. Department of Commerce, 1922, p. 667.

[244] *Annuaire international de statistique agricole*, 1909-21, pp. 237-248.

weight of sheep and lambs slaughtered in Bulgaria in recent years:[245]

SLAUGHTERINGS OF SHEEP AND LAMBS IN BULGARIA

Date	Sheep		Lambs	
	Number	Meat, Pounds	Number	Meat, Pounds
1920	115,000	4,148,000	382,000	5,770,000
1921	140,000	4,387,000	389,000	5,967,000
1st 9 mos. 1921	79,794	2,657,000	383,449	5,853,000
1st 9 mos. 1922	100,295	3,209,000	475,767	6,075,000

ALBANIA

Albania is a rugged and backward country on the Adriatic side of the Balkan peninsula. There are no banks, no currency and no railroads. Much of the country is uncultivated and what is under cultivation is developed in a most primitive way. No statistics of the numbers of live stock are available, but it would appear that the animal industries were relatively important. Sheep and goats appear to be very common. They are usually managed on the migratory basis, being pastured on the highlands in the summer and the lower sections in winter.[246] Pigs also are important, with the non-Mohammedan elements of the population, being pastured in the forests in the summer and fed in sties in the winter.[247]

GREECE

Greece is largely a mountainous country broken up to a considerable extent by the sea. Nevertheless, the climate

[245] *Foreign Crops and Markets,* U. S. Department of Agriculture, May 2, 1923, p. 305.

[246] J. Dedijer, "La Transhumance dans les pays dinariques," in *Annales de Géographie,* Année XXV, No. 137, p. 353.

[247] C. Massetti, in *L'Agricultura coloniale,* anno 13, No. 8, pp. 294-296.

is dry. The valleys are narrow and the coastal plains small, but there are extensive table-lands in the mountain regions.

Pigs and cattle are relatively scarce, but sheep and goats are numerous. The density of the goat population in northern Greece and in Albania and that part of Yugoslavia just north of it is the greatest of any part of Europe and probably of the world. Sheep are not quite so plentiful as in the other Balkan countries immediately to the north, but are more numerous than in any other important section of the Continent.[248] In 1923, there were reported to be 687,677 cattle and buffaloes, 334,420 swine, 5,643,344 sheep and 3,674,033 goats.[249] It is said that the number of sheep and goats at the end of the war was 30 per cent below normal on account of the unusual demand for meat during the period of hostilities. The live stock of the country was formerly able to supply the meat requirements of the inhabitants. The value of animal and farm products imported was never more than 6 per cent of the value of the home production. The country is usually, however, to a small extent on the import basis. Local beef production is tending to decrease and pork to increase. Sheep and goat meat, of course, take the leading place in consumption.

Agriculture and animal husbandry in all this section of Europe are based upon extremely archaic methods and are far from being as productive as they might easily be made. If settled political conditions could be assured and modern methods of production established the country could readily produce more meat than its inhabitants now require.[250]

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[248] Finch and Baker, *Geography of the World's Agriculture.*

[249] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 220-236.

[250] *L'Economiste d'Athènes,* Année 1, No. 23, pp. 356-357.

Norway

The meat production of Norway is unimportant as compared with the world's trade. Nevertheless, the live-stock industry is the leading feature of the agriculture of the country and agriculture is the nation's leading economic activity.

Norway's farms are small and scattered among the mountains and along the coast of a highland country bordering the Arctic regions. Seventy per cent of the total area is unfit even for the growth of trees. Almost 23 per cent of the area is forest. About 2 per cent is under cultivation and about 7 per cent in addition is natural meadow and pastures.[251]

In these difficult conditions there has been developed an animal industry with the following numbers of live stock.[252]

Live-Stock Population of Norway

	1910	1921	1924	1925
Cattle	1,133,613	1,049,642	1,114,433	1,150,617
Sheep	1,398,383	1,207,923	1,506,850	1,528,819
Goats	287,686	203,099	258,767	275,783
Pigs	333,709	214,305	249,022	252,959

Cattle and goats are kept chiefly for their milk. Nevertheless, the dairy industry is poorly organized as compared with that of Sweden and Denmark. It is said that only 40,000 cows out of 700,000 are fed and milked in regularly organized dairies. Some interest has been taken in fattening cattle for beef.[253] According to the best avail-

[251] H. Five, "Norwegian Agriculture," *World Agriculture*, June, 1923, p. 241.

[252] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 220-232.

[253] *Cottonseed Products and Their Competitors in Northern Europe*, U. S. Department of Commerce, p. 92.

able estimates, Norway produced nearly 90 per cent of her meat requirements before the war.[254] Recently the imports have been considerably more important and are equal to about three-quarters of the domestic production in inspected establishments. No records are available of uninspected slaughter. The consumption of inspected domestic meats and imports amounts to about 64.94 pounds per capita of the total population. Of this 32.18 pounds are beef and veal, 17.87 pounds pork products, 6.64 pounds mutton and lamb and 8.25 pounds horseflesh and other meats.[255]

It is claimed that with better feeding methods Norway could be made self-supporting in animal products.

Sweden

Sweden is the most northerly country of any importance in the meat trade of the world. Her lands stretch from the borders of Denmark to well within the Arctic Circle. Nevertheless, Sweden produces a surplus of meat and dairy products.

The live-stock industry of Sweden varies with the very diverse conditions of the different parts of the country. In the extreme south near Denmark the land is comparatively level and as much as 60 per cent is cultivated, while in the north less than four-tenths of 1 per cent is cultivated.[256] The rigors of the climate and the hilliness of the land make farming very difficult in the north. In the southern districts conditions are fairly favorable to agriculture.

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[254] McFall, *Livestock and Animal Products Statistics*, 1909-19, Dominion Bureau of Statistics, Canada, pp. 81-83.

[255] Based upon data in *Statistik Arbok, Kongeriket Norge* (1923), pp. 62, 63, and foreign trade as shown on pp. 576-583, *infra*.

[256] H. Juhlin-Dannfelt, "The Present State of Agriculture in Sweden," *International Review of the Science and Practice of Agriculture*, 1916, p. 926.

Fodder was grown on 37 per cent of the cultivated land according to the census of 1911. This was a material increase over the proportion so utilized in earlier years. Of this about one-seventh was employed for pasture or green-forage crops and six-sevenths for hay crops. Very extensive natural pastures also exist, particularly in the highlands. Some of these, of course, are very rough.[257] Root crops are grown extensively and in increasing quantity. Potatoes are of importance particularly for pig feed. The sugar beet provides fodder for the cattle and fodder beets are an important feed in southern Sweden and turnips in the north.[258] The country is not self-sufficing in the production of grain for either man or beast. In the first decade of the century the imports of grain and flour averaged about 400,000 short tons besides grain products, chiefly bran, amounting to about 100,000 tons. This direct import of bran added to the milling offals from over 7 million bushels of wheat and about half as much rye made heavy additions to the feed supplies. Barley and oats were produced somewhat in excess of domestic requirements just before the war.[259] Nearly 67,000 tons of corn was imported, however, in 1913, and in 1921, 117,000 tons of corn went into the country.[260] In 1912, about 192,000 short tons of oil seeds and cakes were imported, in which peanut and sunflower products took first place.[261] Apparently the trade in this type of feed has been fully restored since the war.[262]

The live-stock industry of Sweden was important in early days. However, unsettled political conditions and

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[257] *Sweden, Historical and Statistical Handbook,* Vol. II, pp. 70, 71.
[258] *Ibid.,* pp. 66-70.
[259] *Ibid.,* pp. 48-66.
[260] *Annuaire international de statistique agricole,* 1909-21, pp. 284, 368.
[261] *Cottonseed Products and Their Competitors in Northern Europe,* U. S. Department of Commerce, p. 90.
[262] *Annuaire international de statistique agricole, loc. cit.*

cattle plague did much to destroy the original stock. In the early part of the last century, particularly in the decade 1830-40, breeding stock was imported in considerable numbers from England and to a certain extent from other parts of the Continent.

In the latter part of the century an attempt was made to build up a trade in store cattle for England, but the world trade situation and the British embargo on the import of store cattle in the nineties brought failure to the attempt. The cattlemen then established themselves in the dairy industry. However, before the war broke out, a material export trade in beef and live cattle as well as pork products had been established.[263]

In the exteme north the cattle industry is predominant because the climate is too rigorous for other types of farm production.[264] In the extreme south the organization and success of the live-stock industry are scarcely inferior to the neighboring sections of Denmark.[265] Here the breeding of pigs is important as an adjunct of the dairy industry and the cattle reach their best development both in quantity and numbers.[266] This southern section is the seat of a bacon-producing industry which exports a considerable part of its output.

The live-stock industry, especially that of dairying and the accompanying beef and veal production, is very much more intensively practiced on the small farms. Sheep raising also is important on the smaller and moderate-sized farms, but loses its importance on the larger farms until the most extensive type is reached.[267]

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[263] *Sweden, Historical and Statistical Handbook,* Vol. II, pp. 33, 34, 79-81.

[264] *Ibid.,* p. 41.

[265] *Ibid.,* p. 35.

[266] *Ibid.,* pp. 82, 91, 94.

[267] Hoiger, *Kungl. Landtbruks-Akademiens Handlingar och Tidskrift,* No. 5 (Stockholm, 1922), pp. 361-376.

LIVE STOCK IN SWEDEN[268]

Stock	1913	1920
Cattle	2,722,646	2,736,000
Sheep	972,394	1,568,000
Goats	70,628	113,000
Pigs	977,612	1,011,000

The meat production of the country supplies the moderate demands of the 5,500,000 inhabitants, and provides as well for a net export trade. The average year before the war saw exports amounting to 26,265,000 pounds of meat and fats, and imports amounting to 17,457,000 pounds. During the war both imports and exports declined. In 1919 there was a heavy importation of pork with considerable beef. Since then the imports have declined to an average of about 35,000,000 pounds. Meanwhile, exports have been increasing irregularly and averaged about 46,000,000 pounds in the years 1921 to 1923.[269]

The reindeer industry of Sweden is of the utmost importance to the Lapps and Swedes living in the extreme North of the country. There are estimated to have been about 272,800 head of these animals, in the period before the war. Of these, 231,300 were mountain reindeer which live in the forests only in the winter and graze on the mountains in the summer, and 40,500 were forest reindeer which remain in the forest region throughout the whole year. The territory is considered to be already overcrowded with these animals. Nevertheless, they are very profitable to their owners. About one half of their product is used direct by the owners and the other half is sold to the outside world as meat, skins and various other products.[270]

[268] *Annuaire international de statistique agricole,* 1909-21, pp. 237-247.

[269] See p. 581, *infra.*

[270] *Sweden, Historical and Statistical Handbook,* Vol. II, pp. 101-104.

Finland

Finland lies between the sixtieth and seventieth parallels of north latitude above the headwaters of the Baltic between Sweden and Russia. The population of 3,364,807 is fairly well concentrated in the southern portion of the country, which has a reasonably temperate climate due to the proximity of the water.

Barley will grow as far north as the sixty-eighth, potatoes and rye the sixty-sixth and oats the sixty-fifth parallel of north latitude. In the past a surplus of grain was produced, but the national attention has been directed rather to the raising of cattle. Wheat is but little grown and the production of rye declined by more than 30 per cent in the forty years before 1905. Oats, on the other hand, were produced in greater quantity, the production being more than doubled in that period. At the same time the production of hay, clover and roots was greatly increased.[271] These changes and the increase of the livestock industry continued at least until the end of the war [272] and appear still to be in progress.

Live Stock in Finland

Stock	1910	1922	1923
Cows	1,165,580	1,259,608	1,277,664
Total cattle	1,605,087	1,843,523	1,864,645
Pigs	422,283	378,309	381,715
Sheep	1,329,692	1,570,985	1,549,994
Goats	10,881	11,644	11,577

The foregoing table [273] shows the marked tendency toward increase of the live stock and shows at the same time

[271] Arthur Reade, *Finland and the Finns*, p. 86.

[272] O. Goossen, in *In-en Uitvoer*, Year III, No. 39, pp. 869-871, No. 40, pp. 892-894, reviewed in the *International Review of the Science and Practice of Agriculture*, 1919, p. 368.

[273] *Foreign Crops and Markets*, Jan. 21, 1925, p. 64.

that the cattle industry is very largely devoted to dairying. The high percentage of cows among the cattle is very striking, especially in contrast with the situation in Denmark. In neither country are cattle used to any great extent as draft animals.

The export of animal products so far is confined chiefly to that of butter, which is quite important. The export of cattle reached nearly seven thousand and of sheep nearer eight thousand in 1915. Meats, however, are strongly on the net import basis, the trade in 1919 amounting to nearly 170,000,000 pounds.[274]

The country's agricultural possibilities are by no means well developed. Two-thirds of the country is still in forest. The cultivated land amounts only to 5.7 per cent and the meadows and grassland to 2.8 per cent.[275] The country is not mountainous and much more of the southern portion might be cultivated and the live stock increased. Moreover, pig raising and beef and veal production can in time be readily added to the dairy industry which is, as yet, too highly specialized for a country in such a stage of economic development. The coöperative movement is gaining ground and the peasants are well educated. There is reason to believe, accordingly, that Finland will eventually make its appearance as a surplus meat producer.

Poland

The Republic of Poland comprises an area in Central Europe which before the war was divided among Russia, Austria and Germany. The country is naturally a surplus-producer of foodstuffs in spite of a fairly important industrial development. The invasions during the war and all the consequent disturbances did much to destroy agri-

[274] *Commerce international du bétail et de ses dérivés*, pp. 11-30.
[275] Goossen, *loc. cit.*

culture. Reconstruction is now well under way, however, and exports of foodstuffs have been restored to a certain extent.[276]

The development of the live-stock industry of Poland varied between the portions formerly within the boundaries of the separate great powers. The density of cattle was somewhat greater in the German and Austrian sections than in the part under Russian rule. The development of swine appears to have been strikingly greater in the German section than in the Russian and somewhat greater than in the Austrian. The sheep industry assumed no great proportion in any section.[277] The average for the whole country shows about the same number of cattle per square mile as in France and about as many pigs to the mile as in Yugoslavia.[278]

The best available live-stock statistics, which at best must be estimated, are presented in the following table.[279]

LIVE-STOCK STATISTICS

	Pre-war	1921	1923
Horses	3,495,685	3,289,911	About pre-war
Cattle	8,663,734	8,062,935	About pre-war
Sheep	4,472,591	2,193,003	2,500,000
Pigs	5,486,635	5,287,408	5,800,000

It is apparent that, with the exception of sheep, the numbers of animals have been restored to approximately pre-war levels and that the pigs have actually increased. Poland has also had a reorganization of land ownership

[276] *Foreign Crops and Markets,* Dec. 26, 1923, p. 513.

[277] Finch and Baker, *Geography of the World's Agriculture,* pp. 123-139.

[278] *Annuaire international de statistique agricole,* 1909-21, pp. 237-247.

[279] *Foreign Crops and Markets,* Dec. 26, 1923, p. 525; *Commerce Reports,* May 28, 1923, p. 567; *International Yearbook of Agricultural Statistics,* 1925-26, pp. 212-232.

with an attempt to break up the large estates which practiced extensive agriculture and produced grain for export. As a result, the production of wheat up to 1923 had not reached pre-war levels while that of other grain, particularly the kinds used largely for feed, had been increased.[280]

The statistics of the acreage employed for different uses shows that nearly one half of the total area is under the plow and that about one-sixth is in meadows and pasture.[281] Prior to the war German Poland raised cattle for beef production. In the Russian area the competition of steppe cattle was too keen to allow of any such development. Some development of the beef industry is now taking place, but it is expected that several years will elapse before there will be any particular export of beef.

Estimates show that before the war Poland had an annual export of 150,000 head of beef cattle, 1,900,000 hogs and 5,000,000 head of poultry. Bacon was also shipped to England. Recent statistics show that these exports have been renewed to a considerable extent. The hogs go chiefly to Austria, Germany and Czecho-Slovakia.[282] Some Polish pigs also reach the French markets where they are classed as rather poor in quality. In 1922, Poland exported 181,322 head of all live stock and imported 4,192 head. In 1923, the exports had increased to 213,063 head and the imports to 9,800.[283] In the first ten months of 1925, 88,756 head of cattle, 13,394 head of sheep and lambs, 673,963 head of hogs, 856,563 head of geese and 84,829 head of other poultry were exported. On the other hand, the imports from the United States have decreased.[284] Poland

[280] *Foreign Crops and Markets,* Dec. 26, 1923, p. 522.
[281] *Ibid.,* p. 521.
[282] *Supplement to Commerce Reports,* Poland, 1922, p. 19.
[283] *Commerce Yearbook,* U. S. Department of Commerce, 1923, p. 629.
[284] *Foreign Notes on Meats, Fats, Oils and Livestock,* U. S. Department of Commerce, Jan. 22, 1926, p. 11.

has been importing hog products from the United States during the past few years. In the year ending June 30, 1923, this trade amounted to 2,081,655 pounds of bacon, 6,708,091 pounds of lard and 192,817 pounds of pickled pork.[285]

The New Baltic States

The Baltic States of Lithuania, Latvia and Esthonia were formed out of the Baltic region of Russia at the close of the war. These states are primarily agricultural and agriculture is gradually being restored to approximately pre-war standards. Even before the war these countries found it impossible to compete in grain growing with the plains of Russia. As a consequence, they turned their attention to dairying and cattle breeding, which were better suited to their climatic conditions.[286]

Lithuania is said to be taking steps to copy the live-stock and agricultural program of Denmark, developing the dairy and bacon industries.[287] She has already started to import purebred cattle from Sweden to improve her herds.[288] Esthonia is also developing her live-stock industry. Live animals are being exported to near-by countries and preparations are being made to ship butter and meats to England.[289] Latvia is also taking steps to develop the live-stock industry based upon dairying[290] and is starting an export of domestic bacon to England in addition to the trade in bacon manufactured from Russian hogs.[291]

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[285] *Foreign Crops and Markets,* Dec. 26, 1923, p. 529.

[286] *Commerce Yearbook,* U. S. Department of Commerce, 1922, p. 656.

[287] *Foreign Crops and Markets,* Oct. 22, 1924, p. 412.

[288] *Ibid.,* Feb. 6, 1924, p. 135.

[289] *Supplement to Commerce Reports,* "Esthonia," 1922, p. 26.

[290] *Foreign Crops and Markets,* Feb. 6, 1924, p. 135.

[291] *Foreign Notes on Meats, Fats, Oils and Livestock,* U. S. Department of Commerce, Nov. 7, 1925, p. 3; March 19, 1926, p. 14; *Foreign Crops and Markets,* June 1, 1926, p. 771.

The export of bacon from these states has made material progress during 1925 and the early part of 1926.

LIVE STOCK IN LITHUANIA[292]

Stock	1913	1923	1925
Cattle	918,000	1,285,000	1,339,000
Sheep	1,152,000	1,413,000	1,455,000
Swine	1,358,000	1,897,000	1,488,000

LIVE STOCK IN LATVIA[293]

Stock	1913	1920	1922	1923
Cattle	912,000	691,232	810,000	900,000
Sheep and goats	.....	803,000	1,161,500	1,461,000
Swine	557,000	463,554	402,000	484,000

LIVE STOCK IN ESTHONIA[294]

Stock	1914	1923	1925
Cattle	478,480	512,625	551,262
Sheep	518,439	665,938	718,542
Swine	274,549	338,366	332,644

RUSSIA

Russia, before the revolution, was surpassed only by the United States and India in the number of cattle, and in the number of sheep she was second only to the United States, the Argentine and Australia. Her meat trade with the outside world was small, but the internal commerce within this vast empire, which was backward in many respects, was not without its interesting developments.

[292] *International Yearbook of Agricultural Statistics* 1925-26, pp. 220-232.

[293] *Foreign Crops and Markets*, Feb. 28, 1923, p. 143.

[294] *International Yearbook of Agricultural Statistics, loc. cit.*

The total area of this large country was nearly two million square miles within Europe. In addition, Russia controlled the vast territory of Siberia containing over 6 million square miles in Asia. Postwar changes have reduced the European area by 178,586 square miles, leaving 1,821,353 square miles [295] out of 3,750,000 in the total area of Europe. In the pre-war area there were only 72 head of cattle per 1,000 hectares of the total surface and 132 per 1,000 hectares of productive land. The corresponding figures for sheep were 88.5 and 162. There were few nations in Europe which presented such a poor picture in the matter of numbers of live stock in relation to the area.

European Russia consists chiefly of a broad elevated plain, ranging between 500 and 900 feet above sea level, deeply cut by river valleys and having low mountains along much of its borders. The soil varies from one district to another. The black-earth regions of Russia have long been famous. These naturally fertile lands stretch with interruptions from the Urals on the borders of Asia to the Carpathians which are west of the confines of Russia. The black earth tends to disappear toward the Black Sea and in the valleys of the rivers and is not found in the northern part of the country above a line stretching from the northern boundary of Roumania northeast through Kazan. Altogether it covers about one-fifth of the area but in parts is too dry to be of any great agricultural value. South of the black-earth regions are the vast steppes of the south and southeast which merge into deserts near the Caspian Sea. Originally the home of nomads, within recent decades the steppes have been turned to a large extent into grain fields where the rainfall is sufficient. North of the black-earth regions is a middle agricultural section with a poorer type of soil. North

[295] *U. S. Commerce Yearbook,* 1922, p. 661.

of this, particularly toward the northeast, stretch great regions of forests interspersed with lake and marsh. The forests reach up to the Arctic regions where the climate is too severe for trees. There the tundras are useful chiefly as pastures for reindeer.

The country extends through 30 degrees of latitude from its northern to its southern limits. Nevertheless, the climate of the whole nation presents less variation than might be expected. Change of temperature throughout the year is everywhere extreme. Only on the coast of the Black Sea is the annual variation as little as 108 degrees, while in the other parts of the country it is as great as 126 to 144 degrees. The ranges of temperature are between 22 or 31 degrees below zero (in extreme cases 54 degrees) to 86, 104 or even 109 degrees above zero. The Volga River, even near its mouth in the extreme south, is frozen for three months, while the rivers in the White Sea region in the north are frozen for about five and one half months. The climate of the north is too cold, of course, and the cold extends through too much of the year for wheat; but rye, oats, barley, and potatoes are raised to a limited extent as far north as Archangel on the White Sea; buckwheat is grown as far north as Leningrad and corn is grown a little farther north than Kiev.[296] Lack of sufficient rainfall is a severe handicap in many regions. The central portion of the country has 20 to 30 inches of rainfall in the year, but the north, south and much of the east have less than 20 inches and the region in the neighborhood of the Caspian Sea has less than 10 inches.[297]

A description of the animal industries of Russia of to-

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[296] J. M. Crawford, Editor of English Edition, *The Industries of Russia*, Vol. III, *Agriculture and Forestry*, Department of Agriculture, Russian Ministry of Crown Domains, pp. 93-110.

[297] Finch and Baker, *Geography of the World's Agriculture*, Figure B.

day, even if possible, would serve but little purpose. War, revolution and famine have resulted in very abnormal conditions in the agricultural affairs of Russia. The potentialities of the country appear best in conditions as they were before war started its destruction. Pre-war conditions will, of course, not be restored with any degree of exactness. The resurrected Russia of the future will be very different from the old Empire, but the old status is the best norm by which the country's economic importance may be measured.

The live-stock population of Russia in normal times was greatest in the southern part of the country and diminished markedly toward the north. The greatest density of stock was in the lower Volga and Dnieper valleys and in the western sections now lost to the nation. North of Moscow the numbers grew distinctly less, and above St. Petersburg (Leningrad) the development was small. The areas with the greatest proportion of cattle relative to other animals were in the north, where the total numbers of stock were small, and again in the Cossack territory near the Black Sea. Sheep found their greatest development in the south and pigs in the west with Poland as a center.

In the southwest, animal husbandry has frequently been a separate industry, but throughout the rest of the country it has been associated with agriculture. In the districts nearest to Central Europe the development of the industry did not present a great contrast to that in the neighboring countries. In the northwest and near the Baltic, dairying and fattening cattle for slaughter were the most important developments. In the northeast the raising of cattle was an important branch of what agriculture existed, but the cattle were small and did not fatten well. Sheep and pigs were unimportant there. In the black-earth regions cattle and hogs were raised and fattened in conjunction with grain growing. In the south and southeast breeding

was of great importance. The large estates, recently confiscated, formerly kept large flocks of Merino sheep for the production of wool. The peasants, on the other hand, raised cattle. On the steppes in this part of the country much of the former open range had been turned into grain fields. The custom of the nomads of the steppes was to pasture their herds of cattle and sheep on the lower land in the winter and move them to higher land in the spring. Near the urban centers in the central regions the stock was fairly well cared for and dairying was important. Much of the stock in the central portions of the country, however, was but poorly tended.

The cattle and sheep of the north were seldom fed until fat. The south and southwestern steppes and the Don, Kuban and Ural governments were the chief regions for fattening cattle. These animals were chiefly shipped alive by rail. In some sections the animals were butchered on the farm and the meat frozen and shipped to market. In Russia shipment of frozen meat is possible during much of the year without artificial refrigeration. Artificial refrigeration, however, was developed in Russia at an early date and figured to a certain extent in the long-distance shipment of meat and other perishables.[298]

The table on page 316, showing the origin of live cattle received at Moscow in the year 1907, sheds much light on the production of commercial supplies in the various regions.[299]

The source of other live stock was not nearly so widespread. Pigs came from thirteen central provinces and calves from only five near-by provinces. Sheep also came from local sources. Slaughtered meats came from a wide area, wider even than the source of cattle. Three of the

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[298] Crawford, *op. cit.*, pp. 204-241.

[299] M. Polovinkine, "Moscou, centre de consommation de viandes," *Congres international du froid* (Paris, 1908), Vol. II, pp. 950-973.

Siberian districts, Akmolinsk, Tobolsk and Tomsk, contributed large supplies, and the provinces reaching up to the Arctic Ocean made small contributions. The chief sources, however, were the central provinces, those in the center of the south and Orenburg in the east.[300]

ORIGINS OF CATTLE RECEIVED AT MOSCOW

Territory	1907	1906	1905	Average 1900-1904	Average 1895-1899
Don	62,976	81,188	84,452	63,282	47,189
Kharkoff	47,175	50,114	43,396	42,285	23,458
Voronege	40,044	43,575	49,158	40,484	27,378
Saratoff	53,837	56,967	44,963	30,568	15,158
Samara	13,832	21,379	13,969	15,490	7,934
Kouban	12,030	10,697	8,974	10,217	24,481
Koursk	8,388	5,936	5,557	6,295	6,750
Stawropol	5,087	7,555	9,956	4,679	9,075
Tamboff	6,259	9,082	7,447	5,788	3,296
Ekaterinoslaff	2,120	3,329	2,673	3,332	6,680
Moscow	4,719	2,827	4,728	4,016	3,587
Orenburg	5,419	2,332	539	2,549	2,213
Oural	2,526	2,238	1,253	3,461	1,178
Orel	3,488	1,612	3,477	3,415	1,684
Astrakhan	1,410	1,003	263	2,935	5,478
Simbirsk	514	2,655	283	1,124	5,408
Poltawa	834	1,719	1,174	1,761	4,228
Toula	2,106	1,643	1,569	2,632	1,095
Pensa	1,121	2,894	1,484	780	1,097
Riasan	1,493	910	1,232	1,446	1,608
Tchernigoff	605	341	924	1,086	479
Siberia	2,017	.....	170	320	918
TOTAL	280,573	313,105	289,982	249,762	213,044

In 1910, Moscow received 105,693,970 pounds of meat, of which 32,679,550 pounds were reshipped to other consuming centers. In the same year Leningrad received 157,571,820 pounds, of which an unknown amount was exported. The total meat shipped on the railways in that year was 629,722,290 pounds, of which 57,198,000 pounds

[300] *Ibid.*

were reported as exported and 22,424,310 pounds as imported.[301]

The average consumption of meat in Russia has been reported by the U. S. Department of Agriculture as only 50 pounds per capita in 1899.[302] An Argentinian authority has estimated that it was about 64 pounds per person in 1912.[303] These averages, of course, include the country as well as the city population, and over 80 per cent of the population was rural before the war. The data presented in the preceding paragraph indicate that in the city of Moscow in 1910 there was an average per capita consumption of about 40 pounds of meat shipped into the city after slaughter elsewhere. In addition there were still larger quantities of meats coming from the city abattoirs from the animals transported alive. In the period 1900 to 1904, the local meat supply was 65 per cent and it had been growing for a period of years. In addition, horse meat and considerable fowl were consumed. There seems to be no room to question the conclusion that the consumption of meat in the city of Moscow in 1910 was about 120 pounds per person.

This meat consumed in the Russian cities was largely beef. In Moscow beef constituted approximately 86 per cent of the meat produced in the local abattoirs. Pork took second place with 9 per cent, veal third with 3 per cent and mutton fourth with about 2 per cent. This locally slaughtered meat has been shown to have been about two-thirds of the total from these classes of animals. In addition large quantities of poultry and some horse meat were

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[301] Prof. D. N. Golvonin, "Transportation of Perishable Freight on the Russian Railways," *Proceedings of the Third International Congress of Refrigeration*, Vol. III (1913), pp. 302-313.

[302] Holmes, *Meat Situation in the United States*, U. S. Department of Agriculture, Report No. 109, p. 272.

[303] Juan Richelet, "Salvaguardando nuestra ganaderia," *Rivesta zootecnica*, 1912, p. 708.

consumed. The poultry supplies of Moscow in the early part of the century amounted to about 5,750,000 pounds, or about 3 pounds per person. Of the poultry, hens supplied 59 per cent, geese 16 per cent, ducks 17 per cent and turkey 8 per cent.[304] Apparently the tendency to favor beef rather than other meats is not peculiar to Moscow. The comparative importance of beef in the local markets and the importance of the production of poultry is manifested in the following table of transportation and foreign trade of live stock in 1910.[305]

TRANSPORTATION OF LIVE STOCK IN 1910

Stock	Numbers Transported on Railways	Exported	Imported
Cattle	1,287,417	4,855	133,715
Hogs	870,419	79,889	33,072
Sheep, etc.	450,249	13,446	545,038
Fowls, etc.	.....	6,637,606	88,433

A recent Soviet publication [306] gives the following data on the production of meat in the year 1923-1924. These figures apply to both European and Asiatic Russia with 140 million people, and a column has been added presenting consumption estimates.

MEAT AVAILABLE IN 1923-1924

Kind of Meat	Animals Slaughtered, Numbers	Meat Produced, Pounds	Consumption Per Capita, Pounds
Beef	4,048,000	1,409,085,343	10.2
Veal	8,746,000	607,417,295	4.4
Mutton	27,816,000	1,013,361,000	7.4
Pork	10,848,000	1,668,050,000	12.1
TOTAL	.....	4,697,913,638	34.1

[304] Polovinkine, *loc. cit.* [305] Golvonin, *loc. cit.*
[306] *L'Economie de L'Union des R. S. S.*

Facilities for handling meat for the city trade were surprisingly good. Transportation of meat in cold storage was inaugurated in 1883 when steppe cattle were slaughtered in Kosloff and the meat shipped to Leningrad in special refrigerated cars. Apparently this refrigerated shipment was fairly well developed in Russia at a period early in comparison to that of its introduction in most other countries. The cities were also provided with cold storage houses. Leningrad had two in 1908 with special compartments for beef, pigs, veal, fowl and fish.[307]

The foreign trade in live stock and meats was comparatively small. The exports and imports of live stock in 1910 are given on page 318. This trade had been declining for years in the case of cattle and sheep. In 1887, 46,441 cattle were exported and in 1891, 414,028 sheep were shipped out of the country. The hog exports, however, had shown no progressive change for years. Such shipments were highly irregular.[308] The irregularity was due chiefly to the customs restrictions imposed by Germany from time to time. These restrictions were lightened in 1906 and exports were heavier from that time on. In 1912, 135,626 fat hogs were exported to Germany alone.[309] Poultry also figured heavily in the exports to Germany. In 1913, the value of geese alone in this trade was 31,027,000 marks against 24,801,000 for hogs. Chickens to the value of 5,100,000 marks and ducks valued at 1,891,000 appeared also.[310] The export of meats amounted to 33,713,000 pounds and the imports 127,047,000 pounds a year just before the war. The larger part of these imports con-

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[307] J. J. Polferoff, "Application de la réfrigération à la viande," *Congres international du froid* (Paris, 1908), Vol. II, pp. 688-696.

[308] Crawford, *loc. cit.*

[309] Polferoff, *Materials for the Revision of the Russo-German Commercial Treaty*, Russian Ministry of Finance, 1914.

[310] B. M. Anderson, Jr., *Germany and Russia, a Chapter of Uncertainties*, Chase Economics Bulletin, Vol. II, No. 2, pp. 37, 38.

sisted of tallow, which amounted to about 100,000,000 pounds a year and came largely through the United Kingdom. Odessa was an important export point for live stock and Leningrad figured largely in the export of meat. The imports of meat were largely fresh pork from North China or Manchuria and came by way of the Siberian railway.[311] Needless to say, the foreign trade in live stock and meats disappeared during the war and has never amounted to much since.

Very recently an export trade in hog products has sprung up with England. Live hogs to the number of several hundred a week are exported to the Baltic States where they are slaughtered and the carcasses made into bacon of good quality.[312]

The statistical picture of the development of the livestock industry of Russia shows steady increase among the cattle, small fluctuations of the numbers of sheep and a little more irregularity in the changes in the number of pigs from 1890 to 1913.[313]

The only real development was in the cattle industry and even that was rather rudimentary. The social status of the people was not such as to stimulate great improvement. The Russian peasants were serfs until 1861, and until 1906 most of the land owned by them was held in the antiquated village communal system with its uneconomic small and scattered strips. Russian land ownership and systems of farm management at the beginning of this century were about as bad as those in Denmark in the eighteenth century. Much progress had been made before the war. The peasants owned or rented most of the land

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[311] Wrenn, *International Trade in Meats and Animal Fats*, U. S. Department of Commerce, Trade Promotion Series, No. 26, pp. 97-99, 269-271.

[312] *Foreign Notes on Meats, Fats, Oils and Livestock*, U. S. Department of Commerce, March 5, 1926, p. 3.

[313] Holmes, *op. cit.*, p. 204.

themselves and the communal system was beginning to disappear all over the country. The recent seizure of the remaining estates found comparatively little land to subdivide, excepting that of the more progressive peasants.[314]

Authorities differ as to the use of animal manure on the land. Russian authorities give the idea that the fertility of the soil was maintained in normal times from animal husbandry.[315] Outside critics, however, point out that it was not uncommon for the manure to be piled in heaps and burned to get rid of it. Many areas had been cropped with grain for decades without any application of fertilizer. Naturally, in such primitive conditions, neither agriculture nor animal industry could make rapid progress. The average yield of grain did increase, however. On the estates it increased from 7⅓ to 12 bushels per acre while on the peasants' lands it increased from 6½ to 9½ bushels from the decade of the seventies to the first decade of this century. The peasant farming was inferior to that of the estates, and it was expanding at the latter's expense. Nevertheless, two-thirds of the grain exports came from peasant farms before the war and apparently the livestock industry, aside from wool growing, was chiefly in the hands of the peasants.[316]

The opening up of new land by the railways, particularly in Siberia, militated against greater progress in intensification in the older regions. The cattle buyers were accused of moving their field of operations eastward rather than using their influence to improve production in the older regions.[317] The partial removal of German import restrictions improved the hog industry in the first decade of

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[314] League of Nations, *Report on Economic Conditions in Russia with Special Reference to the Famine of 1921-1922.*

[315] Crawford, *loc. cit.*

[316] League of Nations, *Report on Economic Conditions in Russia with Special Reference to the Famine of 1921-1922.*

[317] Polferoff, *Application de la réfrigération à la viande, loc. cit.*

the century. English breeding stock was introduced and the southwestern provinces, where pork had been raised exclusively for the peasants' own use, turned to the export market. Feeding of hogs with by-products from factories was inaugurated on a large scale and grain was fed more freely. The result was the production of very fat hogs, not popular at home, but in great demand in Germany.[318] This industry should have become quite important in time but for its untimely termination by hostilities.

Recent developments in Russia cannot be determined exactly. Famine has been so pronounced that the chief discussion has been of cereal foods as bare essentials. In 1920, the earlier stages of fodder shortage apparently caused the peasants to give up their stock and meat was more plentiful than in most recent years.[319] The League of Nations gives the following figures to show the decrease in stock before actual famine began. The data evidently cover Siberia as well as European Russia.[320]

LIVE-STOCK DECREASE PRIOR TO FAMINE

Classification	1916 Numbers	1920-21 Numbers	Decrease per cent
Horses	31,700,000	23,700,000	25.3
Cattle	50,500,000	35,200,000	30.3
Sheep	79,000,000	44,800,000	43.3
Goats	3,200,000	2,400,000	25.0
Pigs	19,800,000	13,500,000	31.8

The famine was the most severe in the Volga district and to a more limited extent in the Ukraine. These were very important live-stock areas. By 1922, in the worst districts of the Volga the animals had almost disappeared. In the

[318] Polferoff, *Materials for the Revision of the Russo-German Commercial Treaty, loc. cit.*

[319] K. Leites, *Recent Economic Developments in Russia*, p. 218.

[320] League of Nations, *Report on Economic Conditions in Russia, etc.*

Ukraine, conditions were not so bad, but it was reported that one half to one third of the stock of that section had disappeared and that very few pigs at all remained.

The more recent data are not so disheartening. The following table based upon Soviet data is given in the publications of the U. S. Department of Agriculture.[321] The comparison with 1913 perhaps shows too bright a picture, for the numbers of animals in that year appear to have been abnormally low.

LIVE-STOCK IN EUROPEAN RUSSIA (*Present Boundaries*)
(*Thousands*)

Classification	1913	1916	1923	1924	1925, Preliminary
Cattle, total	30,132	38,545	33,042	37,717	39,669
Swine	11,250	16,692	8,104	15,125	14,203
Sheep	41,955	62,970	47,371	54,676	63,493
Goats	1,159			1,515	
Horses	22,169	23,735	16,051	17,093	18,228

In the famine areas the industry is now recovering markedly, although of course the pre-war levels have not as a rule been reached. The number of horses in 1924 was 110 per cent of the 1922 figure, but only 50 per cent of that in pre-war years. Cattle had increased to 132 per cent of the numbers in 1922, but were only 83 per cent of the pre-war stock. Sheep had increased to more than either famine or pre-war numbers but pigs, while amounting to 196 per cent of the numbers in 1922, were only 70 per cent of the pre-war stock.[322]

The government authorities are encouraging the improvement of the live-stock industry. Demonstration farms

[321] *Foreign Crops and Markets*, April 26, 1926, p. 554.
[322] *Commercial Year-Book of the Soviet Union*, 1925, pp. 65, 66.

are being promoted and a start has been made in importing purebred animals for foundation stock.

What the future may bring forth cannot be foretold with any degree of assurance. The comparatively low quality of agricultural development before the war indicates that there is abundant natural opportunity for expansion. The population, however, is at best backward economically and it will be years before the effect of recent disturbances has been overcome. Eventually Russia should again be a surplus-producing area for both animal products and feeds for the stock in other countries.

CHAPTER VIII

CONDITIONS IN ASIA

THE meat-producing industry of Asia is of importance chiefly to the local populations. In India even this importance disappears almost wholly. In the countries where the doctrines of Confucius predominate, meat eating is not held in high esteem, nevertheless meat is eaten and is becoming more popular in some sections of these lands. Some parts of Asia produce a surplus of animals and meat for export. Indo-China, most of the Chinese countries and Western Siberia export considerable quantities of meat or animals for slaughter. Japan, the Philippines, Eastern Siberia and a few other sections import meat, but almost entirely from other sections of Asia. Siberia has furnished important supplies of meat to the markets of European Russia.

The animals of Asia are very seriously affected by disease. Almost no scientific care is devoted to checking epidemics and the health of the animals depends chiefly upon their immunity to attack, or perhaps rather to their comparative immunity to the extreme results which would overtake animals less inured to these diseases. Much of Asia is also semi-arid and is dried up in the summer. This is particularly true of much of the temperate zone, while the tropical and frigid sections have handicaps of their own. The chief handicap confronting the stock industry of Asia is the lack of care in breeding and caring for the animals. As a rule, the breeds are totally unimproved, or the worst of scrub stock. Such animals, of course, eat

as much as animals which are really productive. If the methods of the industry could be revolutionized, disease stamped out and the breeds radically improved by selection, and perhaps by crossing with other stock, the meat production of the continent could be improved enormously without making any greater demands upon the natural resources. Improvements come slowly in Asia, but they are being made in some sections.

Asiatic Russia

Asiatic Russia includes what is commonly called Siberia, covering the vast northern plains of the continent, and a section of Central Asia south of Siberia which includes Kirghizia and Turkestan. Siberia, properly speaking, is the northern plain country west of Lake Baikal and the Lena River. This is often called Western Siberia. East of Lake Baikal to the Pacific is properly called the Far East.[1]

The northern plains lie to a great extent above the latitude of 50 degrees north and, being distant from the moderating effects of the ocean, the winters in much of the area are long and excessively cold. In the heart of Western Siberia the extremely low temperatures come much farther south than they do in European Russia. The far north is mostly the Arctic tundra, usually described as barren wastes, yet capable of supporting large herds of reindeer. South of this and merging into it is a wide belt of forest. In Western Siberia this forest belt merges imperceptibly into an arable zone at about the 56th degree of latitude. The forests extend farther to the south in the eastern parts and merge into the mountain forests of central Asia as the hills connected with the Altai Mountains are approached. The arable belt is an extension of

[1] L. J. Lewery, "Economic Situation in Siberia," *Supplement to U. S. Commerce Reports.*

the black-earth region of European Russia and is fertile with a fair amount of rainfall over a considerable area. South of the black-earth belt at about 53 degrees north latitude the rainfall becomes less, and more extremely seasonal. This is the region of the steppes which extend southwards through Turkestan. Eastwards toward the Baikals the country is mostly covered with forests with arable land in the valley.

Western Siberia had developed a notable butter industry before the disturbance of the last decade. It is an admirable grain country and could readily develop a large meat-producing industry. Butter, however, suited the transportation handicaps and market possibilities best and a large community specialized on butter production with coöperative marketing.[2] The industry, which is reviving again, is far less intensive than that in Denmark. The cattle are small and relatively unproductive and dairying is not accompanied by an important bacon industry as it is in Denmark, although one section of Siberia does have a considerable number of pigs.[3] The dairy district covers all of the belt of naturally arable land in Western Siberia. Hog raising depends largely on scraps and waste grain and has lost much ground in recent years. There are many sheep in the dairy districts, but they are generally connected with the more extensive types of agriculture and their importance increases southward as the steppes are entered.[4]

The dairy section is a market for the cattle of the southern steppes and of the country toward Lake Baikal, but there seems to be relatively little beef output from the dairy herds. The districts with the greatest dairy de-

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[2] *Report of the Canadian Economic Commission* (*Siberia*), 1919.

[3] *The "Union of Siberian Creamery and Other Associations," and the Country Served by This Organization* (pamphlet).

[4] Lewery, *loc. cit.*

velopment supply about 300,000 cattle and as many sheep for slaughter each year in normal times. The nomads of the southern steppe regions used to drive in about 360,000 head of cattle and 200,000 sheep a year. Of these about 100,000 cattle were shipped alive to Leningrad and the rest were slaughtered and most of them sent to the cities in European Russia as frozen meat.[5] According to the reports of the railway, 96,000,000 pounds of frozen meat, tallow and hides were shipped in 1915. Apparently most of this was beef and mutton.

Going southward into Turkestan the country is mostly steppes, which are very dry at certain periods of the year. Near the mountains and rivers and in various cases where there is sufficient rainfall or where irrigation is possible real agriculture is practiced and alfalfa is grown for the live stock under intensive conditions. On the steppes the population is nomadic and stock raising is the sole occupation. Many of the people spend part of the year in the cultivated regions and pasture their animals on the steppes when there is grass. There also is a marked tendency in some regions to pasture the animals on the higher lands in the summer when the plains are dry and drive them to the lower levels in the season when the grass is on the steppes. The flocks of the nomads are kept in the open the whole year and often suffer severely in the winter from lack of feed.[6]

In the Far East district the animal industries vary in importance from one section to another. In the extreme north and southward to near the mouth of the Amur River the country is mostly mountainous with poor soil and a severe climate. In the interior a few native nomads have herds of reindeer ranging in size from a few animals

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[5] *Union of Siberian Creamery, etc.*

[6] *The Industries of Russia,* Vol. III, *Agriculture and Forestry,* pp. 444-471.

to many thousands. On the coast of the Okhotsk Sea there is a narrow belt of rich pasture with a fair climate, but no commercial opportunity for the development of any extensive live-stock industry. The section near Vladivostok is more thickly settled and consists of a fertile plain. Before the war there were 250,000 to 300,000 head of cattle there and large numbers of hogs and sheep, but yet the local market required additional supplies of meat from Manchuria, Mongolia and Shantung. The yearly consumption of this province before the war called for 150,000 to 180,000 head of cattle weighing 720 to 900 pounds each. It is reported that the city of Vladivostok imported about 100,000 hogs each year from Manchuria and that Harbin, a Russian center in Manchuria, called for 50,000 more. The Russians had done much to stamp out serious diseases in their own territory and imposed careful regulation on the importation of these animals when shipped alive as well as on the import of meats.[7]

Eastern Siberia, or the Far East, will probably for a long time find it easier to import meat and animals from the regions immediately to the south while other industries better suited to the immediate opportunities of the country are developed. If the forests are cut off, the live-stock industry will naturally be developed more thoroughly in the southern portions of the country. The interior of the east is relatively unknown, but some authorities believe the Lena River region capable of being developed as a stock country. Western Siberia has a narrow belt of land admirably suited to live stock which is already fairly well developed. There the numbers of animals and their productivity could be increased very much. The steppe regions could readily be made more productive by modern methods than they are with customs which have not

[7] V. N. Onissemenko, "Food-Producing Animals of North Asia," *Mid-Pacific Magazine*, September, 1924, p. 277.

changed for thousands of years. The forest belt may in time be cleared to some extent for stock. That result will depend partially upon the relative demand for meats and for forest products and partially on the degree to which the forests are carelessly destroyed as they have been in some other lands. The northlands can easily produce a moderate supply of reindeer meat. Siberia is far from having the immediate possibilities of an expansion of meat production that a glance at the map would indicate. However, an expansion of the demands of the world's markets could in time stimulate a great increase in Siberian supplies, either from an extension of the producing area or from an improvement of the methods of production in the older regions.

China

It has been commonly supposed that the live-stock industry is very unimportant in China since the great density of population has induced an extremely intensive cultivation of the soil. It is unquestionably true that an extreme density of the human population has been accompanied by a much greater development of soil cultivation than of animal husbandry. It also is certain that the average Chinaman consumes less meat than the average person in North America or Western Europe. The religion of many of the Chinese discourages the use of meat. However, the live-stock industry has been overshadowed, rather than neglected, and there is some evidence to show that there are more potential meat-producing animals per acre in China proper than in the United States. Unfortunately, the statistics on Chinese live stock are so incomplete and lacking in dependability, and conditions vary so greatly from place to place, that no very satisfactory description of the meat industry of the country is possible.

Those Chinese families which are the most subject to

poverty are said to eat no meat whatever.[8] Studies made by the Chinese Christian University at Tsinan indicate that the consumption of meat and fish amounts to only 2.3 to 6 per cent of the diet in Shantung. A small amount of fat is eaten in addition.[9] On the other hand, King, in his *Farmers of Forty Centuries,* quotes a woman doctor who had practiced medicine for years in Szechwan who held that one reason for the prevailing high rate of infant mortality was the fact that children were fed meat while they were still too young.[10] In northwestern China, where there are about 20,000,000 Mohammedans, beef consumption assumes considerable importance. In other parts of the country beef is not consumed in any great quantities by the ordinary native population.[11] The general dispersion of the pig raising and poultry keeping and what other actual evidence exists, indicate that pork, eggs and poultry, including ducks and geese, are consumed quite generally throughout China by all who can afford such food. Mutton, lamb and goat meat are also eaten to a considerable extent in the north and west. All accounts indicate that milk is almost wholly absent from the diet of the Chinese.[12]

China is situated between the 20th and 40th degrees of latitude and only the extreme south lies within the tropics. Much of the eastern part consists of river plains, but toward the west the country assumes a highland character and the general elevation is high. Portions of the southeastern part of the country are also hilly. The country has

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[8] J. B. Taylor, "The Study of Chinese Rural Economy, the Results of the Famine Commission's Investigations," *The Chinese Social and Political Science Review,* April, 1924, pp. 230-262.

[9] *Peking and Tientsin Times,* March 18, 1924.

[10] F. H. King, *Farmers of Forty Centuries,* p. 331.

[11] Julian Arnold, Commercial Attaché, "Cattle Raising in China," *U. S. Commerce Reports,* October-December, 1918, pp. 981-992.

[12] C. O. Levine, *Notes on Farm Animals and Animal Industries in China,* Bulletin No. 23, Canton Christian College.

an abundant rainfall in the south, but toward the north the precipitation decreases and toward Manchuria, and especially Mongolia, the rainfall is not abundant. Occasional drouths also visit the rainier sections. In the south, agriculture is practiced very intensively, the most extreme conservation methods have been used to preserve the soil fertility and much of the land is leveled off into walled basins or terraces which are flooded for a portion of each year to grow rice. On many fields three crops are grown in each year. Most of the tillage is done by hand. Much even of the transportation of farm crops and supplies is accomplished by means of human labor alone.[13]

In such intensive agricultural conditions it would not be surprising if live stock were crowded out. However, some of the farm work is performed with the aid of cattle or buffaloes with a few donkeys and ponies, and many fowls and pigs are kept for eggs and meat even with the intensive farming. Ducks and geese get much of their living on the numerous canals, and sheep and goats pick up a living on the hillsides and on the grave-mounds which abound everywhere and frequently preëmpt one half of the surface of the land best suited to cultivation.[14] In China fenced pastures appear to be unknown, but there are so many human workers around at all times that the animals are kept from interfering with the crops even when running free, as they do, to pick up a part of their own living. King speaks of the flocks of sheep and goats herded along the unfenced pathways eating the poorer pickings beside the crops, but never touching the growing grain.[15] The pigs and poultry also run at large through the villages picking up what they can to supplement their rations.[16]

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[13] King, *op. cit.*
[14] *Ibid.*, pp. 48-59.
[15] *Ibid.*, p. 235.
[16] Levine, *op. cit.*, p. 19.

The actual number of animals in the country is largely a matter of conjecture. Official estimates are available for many of the provinces, but even these estimates have a large degree of uncertainty. The sheep in the country are variously estimated at 22,000,000 to 45,000,000,[17] the larger number evidently covering the northern territories. Unsettled political conditions have stood in the way of comprehensive official estimates in recent years. The estimates of about ten years ago credited very few sheep to Manchuria, while more recent information indicates that one half of the total number of sheep produced in the Republic of China is found in two of the Manchurian provinces.[18] It seems probable that China proper has nearly 20,000,000 head of sheep. An authority at the Canton Christian College states that conservative estimates place the cattle population at 50,000,000 head and the number of pigs raised each year at 100,000,000.[19] He fails to state whether these estimates refer to China proper or to the whole of what is called the Republic, which includes the vast semi-arid northern territories. All the internal indications in the publication point to the conclusion that these figures refer to China proper, which has an area equal to about one half of that of the United States. Since the latter country has about 67 million cattle and 38 million sheep and slaughters only about 75 million hogs a year, it would appear that the live-stock industry of China was comparatively more important per unit of area than that of the United States. King estimates that the density of animals in Shantung is equal to 21,500,000 cows, 21,500,000 donkeys and 86,000,000 swine for an area equal to Wisconsin.[20] Wisconsin itself has less than 2 million swine and only about 3 million cattle. The Province

[17] *Foreign Crops and Markets,* Dec. 24, 1924, p. 681.
[18] *Ibid.,* May 31, 1923, p. 402.
[19] Levine, *op. cit.,* pp. 18, 31.
[20] King, *op. cit.,* p. 233.

of Yunnan in the southwest, with an area of 146,680 square miles, much of which is mountainous, is reported to have 308,000 horses, 124,000 donkeys, 605,000 cattle, 1,062,000 sheep and 1,484,000 pigs.[21] It is very evident that the live-stock industry is far from being unimportant.

Poultry are everywhere present and the consumption of fowl and eggs is common in all sections among the classes which can afford it. The rough assumption is made that the country has about 400,000,000 fowls. Ducks and geese are also common.[22]

The Chinese hogs belong, as a rule, to the lard type. The meat is of good quality and cures well. At a year they weigh 200 to 250 pounds and will give a carcass yield of over 70 per cent. These hogs are fed too much wet feed and in consequence have low backs. They are described as "swayed-backed hogs."[23] Pigs are usually kept in enclosures at night and allowed to roam in the daytime, but they are fed regularly. In the vicinity of breweries hogs are sometimes fed in commercial plants in large numbers. In the hilly and wooded regions of the western provinces the hogs belong to the bacon type. The breeding of pigs is very unsystematic and the types might be improved greatly. It is worthy of note that some of the best occidental breeds of hogs are based upon stock originally from China. In spite of insanitary conditions and the free roaming of the pigs, there is very little disease among them excepting cholera, which is very prevalent. Pig meat is largely consumed fresh, the meat being sold at retail the day the pigs are slaughtered. The meat merchants have a very common custom of increasing the weight of the carcass by injecting several pounds of water into

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[21] *Foreign Crops and Markets,* June 14, 1922, p. 300.
[22] Levine, *op. cit.*, pp. 6-13.
[23] A. W. Pontius, "Animal Industries in the Canton District," *U. S. Commerce Reports,* July 11, 1919, pp. 215-225.

the veins after slaughter. Considerable pork is cured in the western provinces and shipped to the eastern markets.[24]

The sheep belong to the fat-tail, hornless variety and have a moderate amount of wool. These animals are found in the east,[25] but apparently they are most common in the highlands of the west and the north.[26] Sheep are shipped from the north to Canton for consumption.[27] The Province of Yunnan in the southwest, with its high plateaus and mountains and its temperate climate, produces sheep in most of its area excepting the lower valleys. These sheep are raised for meat and wool and are tended by Chinese Mohammedans. Flocks of one hundred sheep mixed with goats are not uncommon. Conditions in the industry are very far from ideal. Breeding is haphazard and there are no public abattoirs. The dressed carcasses weigh about 35 pounds and although the flesh is tender and savory when it comes from young animals, the carcasses are generally too lean.[28]

Goats are common and are usually raised for meat alone.[29]

The cattle of China are classed among the humped species. Shantung, Chihli and Honan, in the north, and Szechwan, Yunnan and Kwangsi Provinces in the southwest produce cattle in the largest numbers. The cattle of the south are small, but those of Shantung are quite large, the ox sometimes weighing as much as 1,300 pounds. The Shantung cattle are mostly the product of the flood plains of the Yellow River which are not fit for cultivation. The village cattle are pastured on the wild grass and

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[24] Levine, *op. cit.*, pp. 18-26.
[25] King, *op. cit.*, p. 235.
[26] *Foreign Crops and Markets,* May 31, 1923, p. 402.
[27] Levine, *op. cit.*, pp. 27, 28.
[28] A. Hallot, "Yunnan Breed of Sheep," *Bulletin de l'Indochine,* March-April, 1915, pp. 165-182.
[29] Levine, *op. cit.*, pp. 27, 28.

weeds of these meadows, when they are not flooded, the whole herd being watched by one coolie. When artificial feed is necessary, they are fed on straw, hay, grain and various waste products. The Shantung cattle are drained from all through Central China and the west and are becoming the basis for a growing export business. Cattle are raised also in the south. It is said that the best beef animals that reach the Hongkong market come from south of Swatow in Kwangtung Province in the southeast. Hongkong also gets cattle from the West River region and from the Canton district.[30] Wuchow on the West River was shipping 25,000 to 50,000 head of cattle annually a few years ago. Western Szechwan and southwestern China also raise cattle in considerable numbers. Southern Fukien has had a thriving cattle industry and is reported to have splendid grazing lands. Disease has hurt the industry in southern China during this last decade. The native cattle are practically useless as dairy animals and are bred for work and meat. Since the Chinese country people are not beef eaters to any large extent, the meat is usually subordinated to work excepting when the animals are raised for the Mohammedans or the export market. Unfortunately the cattle are subject to rinderpest and anthrax and tick fever is also prevalent in south China. Apparently the native cattle are more or less immune to the effects of these diseases. Fortunately, tuberculosis is almost unknown.[31]

Water buffaloes are common in all parts of China as far north as Shanghai and are present to a certain extent much farther north. These animals are kept mainly for their use as work animals and recently they have been used to a certain extent for milk production near the cities.

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[30] *Ibid.*, pp. 31-33.
[31] *Ibid.*, pp. 49, 50; Arnold, *loc. cit.*

When their usefulness is past for other purposes the buffaloes are slaughtered for beef.[32]

The exports of meats and fat from China are important. In 1917, 10,000 tons of lard were reported by the United States Commercial Attaché to have been shipped from ports in China proper.[33] In the same year Hongkong shipped an additional 500 tons of lard to the United Kingdom alone, according to British statistics, and by 1919 this amount had risen to 1,500 tons. Evidently the exports from China itself also rose until 1919.[34] The export from Hongkong is based upon products raised outside of its own political confines. It has also shipped quantities of beef and mutton, especially to the Philippines. At one time an important part of the Philippine imports of beef and mutton, with considerable pork and lard, came from Hongkong.[35] Frozen beef, pork, mutton, ducks, chickens and game birds have for years been established products in China's export trade. Poultry and ducks come from all over the country. Pork comes from many provinces, some of which are in the interior. Beef comes from northern, western and central China, especially from the northwest, where there are large beef-eating Mohammedan populations, as well as from Hongkong and Shantung. Shantung has become the most prominent exporting center, it being estimated in 1918 that 30,000,000 pounds of beef a year were exported. Wuchow on the West River was shipping 25,000 to 50,000 head of cattle annually. Shantung is also spoken of as shipping 75,000 head of cattle in a year,[36] but it is not clear whether or not this is in addition to the dressed meat

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[32] Levine, *op. cit.*, pp. 35-37.
[33] Arnold, *loc. cit.*
[34] *Annual Statement of Trade of the United Kingdom*, Vol. II (1919), p. 402.
[35] *United States Commerce Reports*, January-December, 1917, p. 949.
[36] Arnold, *loc. cit.*

mentioned above. The trade from Shantung is said to have been originated by the Russian government at the time of the Russo-Japanese War. The Germans also stimulated the industry during their occupation of Kiaochow. In 1913 this leased territory is said to have supplied 37 per cent of China's export of cattle and 49 per cent of the export of fresh meat, the chief destination being Siberia.[37] Tsinan is said to be the largest market for the collection and distribution of cattle, although there are cattle markets in several places in Shantung where buyers and sellers congregate on certain dates. Tsingtao is the most convenient place of export in Shantung[38] and a British company has established a slaughtering and refrigerating plant in Nanking, in a neighboring province, in connection with the Shantung cattle trade.[39] The export from Tsingtao has been increasing rapidly. The pre-war average of this trade called for 11,850 head of cattle in the principal packing house. In 1918, 36,675 head were taken. In 1919, 47,757 head and in 1922 about 73,000 were slaughtered in this establishment. The greater part of this trade now goes to Japan, where the consumption of beef is small but increasing rapidly.[40]

Most of the export statistics include shipments from Manchuria and Mongolia. This is undoubtedly true of the data published by the International Institute of Agriculture. The statistics of the Institute show an export of 30,000 to 60,000 head of cattle a year with imports running nearly to 6,000 in one year and exports of sheep of 20,000 to 30,000 and of goats 5,000 to 7,000 head a year. The exports of pigs approximate 30,000 head a year and imports have been as many as 15,000 head. The exports of pigs, however, have been chiefly to Hongkong,

[37] *China Year Book*, 1919, p. 47.
[38] *U. S. Commerce Reports*, October-December, 1917, p. 572.
[39] *China Year Book, loc. cit.*
[40] *Foreign Crops and Markets*, May 31, 1923, p. 402.

which is a British district, and the imports were from Macao, which is a Portuguese possession. Hongkong also figures largely in the trade in cattle and sheep, and Russia and Japan take the next places. Fresh and frozen beef, mutton and pork, amounting to as much as 50,000,000 pounds, and about 38,000,000 pounds of cured meats were exported in 1919. Russia took the leading place in the fresh and frozen products before the war and Great Britain took the leading place during the war and immediately thereafter. The Philippines and Japan also took a prominent place in the fresh meat trade and Hongkong in that of cured meat.[41] British import statistics for 1919 show that 30,452,128 pounds of bacon and ham were received from China, exclusive of Hongkong, in that year.[42] This figure is only slightly greater than the exports reported as going to Britain in that year by the International Institute of Agriculture. It is a question if the official reports quoted by the latter record all the shipments into Siberia. Dr. Onissimenko, Veterinarian of the Chinese Eastern Railway, reports Manchurian exports to Vladivostock alone as amounting to 100,000 hogs.[43] In 1924 Great Britain received 135,089 long tons of mutton from China.[44]

It is evident that China, both in the narrower geographical sense and as the larger area formerly in the Empire and now nominally in one Republic, assumes considerable importance in the world's meat trade. It is surprising that a country with such a large population of its own should be able to contribute extensively to the outside world's

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[41] *Commerce international du bétail et de ses dérivés,* p. 94.

[42] *Annual Statement of Trade of the United Kingdom,* Vol. II (1919), p. 276.

[43] Onissimenko, "Food-Producing Animals of North Asia," *Mid-Pacific Magazine,* September, 1924, p. 276.

[44] Weddel and Company, *Annual Review of the Frozen Meat Trade,* 1924.

food supply. However, not all sections of China are densely populated and the famines are partially due to occasional failure of the customary food supply caused by drouth or flood, and to lack of adequate facilities for internal distribution. Whether or not the world may look to China for an increasing, or even continued, supply of meat, is open to question; and questions regarding China are difficult to answer. The animal industry of South China has suffered seriously from anthrax and other diseases. These diseases could be checked with modern methods and this hindrance to meat production largely removed. The breeds of animals can also be improved decidedly. At present much of the Chinese lands is used very intensively, but many parts of the hills are not being utilized as they should be, grass and other vegetation being removed for fuel or direct application for fertilizer instead of being used first for feed. China has for centuries been using feed resources for fuel that can be released for animal husbandry if the coal resources are developed.[45] The enormous area devoted to graves presents a problem. This is now in places one half of the area of the good land. It would seem that the increasing pressure of population and the tendency of the grave lands to increase would eventually tend to overcome the very real social forces standing in the way of the utilization of this land, perhaps by causing a removal of the graves to the less fertile hills. No such movement will come soon. However, it appears that the hillier sections of the west and north are utilized far less intensively at present than the coast with which the outside world is best acquainted. It is certain that in these last two decades China has increased its exports of meat and that the trade seems to be continuing to expand. The greatest opportunities for expansion must come, however, from the

[45] King, *op. cit.*

northern territories nominally, at least, belonging to China. Manchuria, Mongolia and Sinkiang are by no means densely populated, and, while the water supplies are far from good, there is great room for expansion of the live-stock industry in these large territories.[46]

MANCHURIA

Manchuria is a Chinese territory extending northward from the Gulf of Chihli between Mongolia and Korea to the Amur River which borders Siberia. The Chinese have been colonizing the country very rapidly since the railway was built and much of the land is now being farmed by them. Soya beans have been exported to a certain extent for centuries, but, following the Chinese development of the country, this trade has assumed large proportions. Wheat and other grains are also raised for export.

The live-stock industry of Manchuria was assuming a considerable importance before the collapse of the Russian markets and the slackening of the demand from western Europe since the war. Unfortunately, it is difficult to determine how much of the fairly important trade in meat going into Russia by way of Siberia and Manchuria originated in the latter country and how much came from farther south. It also is impossible to determine how much of the present exports by sea are based upon stock raised in Manchuria and how much upon stock originating in eastern Mongolia. Accurate data as to the numbers of animals in the country are also unobtainable.

The country has an area of approximately 363,000 square miles and, while the rainfall is light for the most part, actual cultivation of the soil is practiced extensively, especially in the south. Nomadic steppe-herding exists only to the west of the Kinghan Mountains in Mongolia. In

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[46] Arnold, *loc. cit.*

Manchuria itself the live-stock industry is associated with farming and the animals are kept in barns and given feed.[47] Hog raising takes the first place in the more densely populated districts, but the cattle and sheep industries are also important. Cattle are kept by all the farmers, and generally pigs and fowls are also raised. The sheep are said to suffer from too much housing. The available land is not by any means all cultivated as yet, and it is claimed that there are large grassy plains available for grazing.[48] With the disorganization of markets since the war the industry has suffered. A British company is running a modern packing plant at Harbin and is exporting beef, mutton and game. The stock is bought in the country by Chinese merchants and brought to the lines of the Chinese Eastern Railway, where the animals are kept on grass for a time and then slaughtered for the local trade or for export. It is reported that in 1922, 45,863 cattle and 104,897 sheep went through the slaughterhouses in North Manchuria and 900,000 hogs were killed in public slaughterhouses. There is no record of the farm slaughter, which is an important item.[49]

MONGOLIA

Mongolia is a vast and indefinite country north of the Great Wall of China and south of Siberia. It stretches from Manchuria on the east two-thirds of the way across Asia to the Tarbagatai Mountains which are in about the same longitude as Ceylon. The country as a whole is a great inland plateau broken in places and bordered on all sides with mountains excepting toward China. No part, save the mountains, gets an abundant rainfall. The

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[47] *U. S. Commerce Reports,* Dec. 31, 1923, p. 873.

[48] T. Hoshino, "Wealth of Manchuria Not in Beans Alone," *Trans-Pacific Magazine,* June, 1921, pp. 72-76.

[49] *U. S. Commerce Reports, loc. cit.*

land, as a rule, consists of grassy plains tending toward the center to desert conditions. The central strip running from east to west is called the Gobi Desert. This is a real desert in the west, but toward the east it is only a semi-arid plain covered with sage brush and bunch grass and having ample well-water supplies within a short distance of the surface of the ground.

The Mongols are nomad pastoralists and do not farm their soil. Their flocks of sheep furnish a large part of their food. On the southern edge of the country the Chinese are pushing their farms northward.[50] There are a few valleys where agriculture may be carried on successfully, but these are the exception. It is a question, of course, how far in from the better-watered edges tillage may eventually be pushed with dry-farming methods. Much of the country, however, is better suited to grazing than farming.

There is no certain information as to the numbers of live stock in the country. Grigorieff, who is well acquainted with local conditions, gives credence to the estimates of some authorities who claim that the country has as many as 20,000,000 cattle, 75,000,000 sheep, 25,000,000 horses and 12,000,000 camels. He gives data for certain districts, concerning which the facts are better known, which he thinks support these striking figures.[51] Dr. Onissimenko, Veterinarian of the Chinese Eastern Railway, estimates that there are three to six million head of cattle and many sheep.[52] The country is capable of sustaining very large flocks and herds, certainly much larger than those now in existence.

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[50] Roy Chapman Andrews, "The Romance of Mongolian Reality," *Trans-Pacific Magazine*, May, 1920, pp. 37-41.

[51] G. S. Grigorieff, "Looking to Mongolia for Meat," *loc. cit.*, February, 1920, pp. 76-78.

[52] Onissimenko, "Food-Producing Animals of North Asia," *Mid-Pacific Magazine*, September, 1924, p. 277.

The live stock now raised in the country belongs solely to native breeds which suit the peculiarities of the country, but, of course, are not as productive either as European breeds, or as these breeds themselves might be made, by means of attention to scientific breeding practices and eradication of disease. Natural conditions have produced very fair meat animals in the native cattle and sheep. Unlike most of the Oriental cattle, those of Mongolia are not work animals but roam the pastures at will. As a consequence, the quality of the beef is fairly comparable to that of western countries where the lean meat is interspersed with fat. Animals of four to six years, taken at the height of condition when the grass is good and slaughtered properly, yield meat of a quality fit for the European market.[53] The sheep also give a good carcass of fair weight. Like the beef, the mutton is well interspersed with fat, and the flavor of the meat is quite superior to that of some other eastern breeds.[54]

The grass is not abundant in many sections and the grazing is poor in the winter. Frequently the animals are forced to get their feed from under snow and sometimes ice during the winter. The grass, however, appears to have highly nutritive qualities and water can be had in most of the grazing land for no greater expenditure than that of digging a well when surface water supplies are not available.

Before Russian economic life was disturbed by the revolution, cattle in fairly large numbers found their way from Mongolia into Siberia and thence into the Russian markets.[55] Recently, animals from the eastern section have found their exit through Manchuria and thence to British markets. During the last few years the markets

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[53] Grigorieff, *op. cit.*
[54] Wrenn, *International Trade in Meats and Animal Fats.*
[55] Grigorieff, *op. cit.*

in all directions have been very unfavorable and the industry has not progressed.[56] With modern methods of breeding, disease control, winter feeding and marketing, Mongolia could become a very important source of meat, especially in the form of animals to be fattened on more productive lands nearer to the world's markets.

TIBET AND SINKIANG

Tibet and Sinkiang lie in the very heart of Asia north of the Himalaya Mountains. Tibet in particular has an extreme elevation. Some of the valleys are cultivated, but the higher regions are mostly semi-arid steppes which are extremely cold in winter. Large numbers of sheep and goats and cattle and yaks, the latter partially interbred, are pastured on these plains by the nomadic population. These countries are so inaccessible that they will probably furnish nothing but wool and hides to the world's trade in animal products for many years to come.

KOREA

Korea is a peninsula stretching from Manchuria toward Japan, which now controls it politically. Much of its area of 85,000 square miles is mountainous, but its agriculture is highly developed after the manner of Japan. Live stock is raised as a by-product of agriculture, but is not very important except for draught purposes, although some cattle are exported to Japan.[57] In 1922 there were reported to be 1,607,707 cattle, 1,100,721 pigs and 23,193 goats.[58] There are very few sheep and the government is attempting to introduce Mongolian sheep.

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[56] *U. S. Commerce Reports,* Dec. 31, 1923, p. 873.
[57] R. Iwazumi, "Heavy Odds Oppose Japan's Animal Industry," *Trans-Pacific Magazine,* May, 1921, p. 66.
[58] *Statesman's Year-Book,* 1925, p. 1078.

JAPAN

The Japanese did not eat meat before the country was opened to the outside world in the last century. Cattle were kept for work purposes, but their flesh was not eaten nor their milk drunk. Even poultry and eggs were neglected as a food. Fish has always been eaten, but the annual per capita consumption of this food has only recently risen from 30 to 50 pounds.[59]

During this last half century, and especially since the Russo-Japanese War,[60] the use of meat has been gaining in favor, particularly among the wealthier classes. It is still very limited, however, amounting only to about three pounds per capita in 1919 and five pounds in 1923. Beef is the only meat that really finds favor with the Japanese, although horse meat is used to some extent and the use of pork is increasing. Religious scruples have stood in the way of meat consumption, but the chief deterrent today is said to be the excessive cost, in spite of the fact that the animal industries of Manchuria have been languishing for markets. With the present prices it may be considered certain that the poorer classes get none at all.[61]

The figures given in the table on p. 347 show the meat consumption, some of the cattle slaughtered undoubtedly being from Korea and many from China.[62]

In 1920 there were 538 slaughterhouses in Japan and 36 factories engaged in making bacon and ham.[63]

Data for the year 1923 show the following production of meat from domestic and imported animals:[64]

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[59] Iwazumi, "Heavy Odds Against Japan's Animal Industry," *Trans-Pacific Magazine*, May, 1921, pp. 63-68; H. B. Titus, *U. S. Consular Report*, Sept. 26, 1925.

[60] *Journal of the Board of Agriculture* (England), Vol. XVII, p. 154.

[61] Titus, *loc. cit.; U. S. Commerce Reports*, Oct. 8, 1923, p. 123.

[62] Iwazumi, *loc. cit.*, and Titus, *loc. cit.*

[63] *Foreign Crops and Markets*, Aug. 30, 1922, p. 130.

[64] Titus, *loc. cit.*

Beef	111,349,540	pounds
Pork	48,820,151	"
Mutton	9,730	"
Horse	19,945,603	"
Goat	164,751	"
Chicken and duck	64,604,462	"

In addition to this, 35,698,444 pounds of beef were imported, mainly from China, with small supplies from Australia and Canada.

NUMBER AND WEIGHT OF ANIMALS SLAUGHTERED[65]

ANIMALS	1913		1919		1920	
	Number	Pounds	Number	Pounds	Number	Pounds
Cattle ..	254,000	93,129,000	230,000	88,998,000	257,000	95,905,000
Calves ..	13,000	2,116,000	12,000	1,201,000	15,000	1,563,000
Horses ..	64,000	16,473,000	70,000	19,289,000	63,000	16,580,000
Swine ..	194,000	22,603,000	357,000	42,241,000	411,000	49,951,000
Sheep ..	850	48,000	145	7,000	223	15,000
Goats ..	6,000	115,000	10,000	213,000	12,000	284,000

Domestic beef is preferred to imported supplies, frozen meat being especially unpopular. The greater part of the imports come from Tsingtao, China From February to November cattle from this origin are imported exclusively on the hoof and distributed in this manner to the localities where the meat is to be consumed, but during the period from November to February approximately one half of the importation is in the form of fresh meat or meat that is merely chilled and not frozen.[66]

It is estimated that there were 1,456,243 cattle, 743,283 swine, 15,710 sheep, 157,852 goats and 1,568,685 horses in the country in 1924.[67]

The native cattle were small, but they have been freely crossed with imported stock and now the cows average

[65] *Foreign Crops and Markets,* Aug. 30, 1922, p. 130.
[66] Titus, *loc. cit.*
[67] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 214 *ff.*

about 800 pounds in weight and the bulls 1,000 to 1,200 pounds. Pig breeding in Japan proper is a modern thing, although pigs have been raised and pork eaten in the Loochoo Islands for centuries. The greatest concentration of swine is still found in these latter islands where the native Chinese breeds have been improved somewhat by importation of European stock. The earlier attempts to introduce sheep were failures, but the government has recently concluded that these animals also can be established in Japan.

The introduction of live stock is meeting with difficulties. Most of Japan's area is mountainous and the portions which are fit for cultivation, excepting on Hokkaido, were put under intensive cultivation long ago. In most lands the hills would be used for live stock. In Japan, however, whether from centuries of stripping of the hillsides of all herbage for fuel and compost material, the steepness of the hills or the prevalence of bamboo grass which is injurious to the animals which eat it, the hills are not used extensively for pasturage. Excepting in Hokkaido, the fodder for the animals consists chiefly of the various materials which formerly went direct to the soil in the form of green manure. The government, however, is doing its utmost to stimulate the live-stock industry and is already setting an example to other oriental lands in the aid which it is giving in improving the native stock and stamping out disease.[68] The farmers also are bending their energies to the development of beef-producing breeds suited to the peculiar mountainous conditions and are already practicing fattening on a systematic basis.[69] Hokkaido offers a real opportunity

[68] Iwazumi, *loc. cit.*

[69] Department of Agriculture and Commerce of Japan, "The Present Conditions of Cattle Farming in Japan," in *Cattle Breeding,* Proceedings of the Scottish Cattle Breeding Conference, 1924, pp. 465-487.

for the development of a live-stock industry of small proportions. The island has an area of about 7,500,000 acres of land fit for cultivation and the climate is excellent. There are only 32,300 oxen, 36,500 hogs and 1,650 sheep on the island now and the aim of the government is to have these increased to 540,000 head of beef cattle, 300,000 sheep and 3,000,000 hogs.[70]

The Philippines

The Philippines have a total area of 119,542 square miles on several thousand islands. Forty-eight thousand square miles are in grassland and only 12,000 square miles under cultivation. One reason given for the small proportion of land cultivated is that there are not sufficient cattle and buffaloes for draught animals, only about one animal being available for each eight acres of land already cultivated.[71]

Numbers of all classes of animals are increasing. In 1924 there were 1,732,000 buffaloes, 949,000 cattle, 7,887,000 hogs, 1,216,000 goats and 319,000 sheep.[72] Nevertheless, animals are brought in for working purposes and for slaughtering, and dressed meats are also imported. Indo-China is an important source of live stock. China, Hongkong and Australia also ship in live stock and the Philippines are Australia's second best market for frozen beef.[73] In 1915, 16,672 head of cattle were imported at Manila and only 3,753 native cattle slaughtered. In 1918, when war conditions had cut off imported supplies, only 2,002 head

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[70] W. L. Seaman, "Japan for Stock Raising," *Mid-Pacific Magazine,* September, 1924, p. 243.

[71] A. Hernandez, Director, Bureau of Agriculture, "Freeing Philippines from Animal Imports," *Trans-Pacific Magazine* (August, 1920), pp. 78-80.

[72] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 220-236.

[73] *Foreign Crops and Markets,* May 18, 1925, p. 576.

were imported and 19,715 native cattle were slaughtered.[74]

The native cattle are very small. One breed which shows the influence of Spanish stock gives an average weight of about 200 pounds. Other breeds vary in dressed weight between this and 135 pounds. These, of course, are grown animals of at least three years of age.[75] Cattle and buffaloes are the draught animals in farming and, in consequence, do not, as a rule, give a good quality of meat. All classes of animals are neglected. Scarcely any attention is given to the use of the imported breeding stock and of the native stock the best animals are sold and the runts left for breeding. Disease is very common in spite of the efforts of authorities to stamp it out. Preparation of vaccines and serums and the inoculation of live stock by the government agents has done much to mitigate the effects of disease, but there is little hope of solving this problem until imports of live stock from the mainland of Asia are stopped.

The Director of the Bureau of Agriculture makes the following statement regarding future possibilities of the live-stock industry: "Many natural features render the Philippines particularly well adapted to live-stock raising. Millions of acres of available grassland make it one of the countries where cattle ranching may still be conducted on a large scale. The climate permits herds to range the entire year. No expensive outlay for building is necessary. Numerous streams furnish a good supply of running water, and only a limited area suffers from a prolonged dry season. Immense regions receive occasional showers during the dry season, while other parts enjoy frequent rains throughout the year. Of the natural grasses, covering the open areas, cogon is the most common. When

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[74] Hernandez, *op. cit.*

[75] V. Buencamino, "Our Meat Supply," *The Philippine Agricultural Review*, Vol. XV, No. 3 (1922), pp. 237-240.

this grass is burned over or kept down by grazing, the young shoots make good pasturage which is readily eaten by all native stock. Under continuous pasturing, the grass becomes finer and is gradually replaced by better grasses."[76]

French Indo-China

French Indo-China lies to the south of China, its northernmost part being just within the tropics. Its livestock industry is of importance for local meat consumption and for the working qualities of the cattle and buffaloes. A considerable quantity of meat and an important number of live stock are also exported to other countries in the Far East.

The official reports for 1922 showed 1,800,000 cattle, 1,880,000 buffaloes and 3,000,000 swine. It is freely admitted that these figures are an understatement of the actual numbers in existence, for the people hesitate to tell the taxing authorities the full truth about their possessions. The province of Cambodia leads in the number of cattle and Laos is next to it in number of cattle and leads in the number of buffaloes. Sheep are very unusual in any part of the country.

The great plains of the deltas in Tonkin and Cochin China, where the cattle and buffaloes are used as draught animals in the rice fields and rubber plantations, contain many of these animals, but the conditions under which the industry is carried on are so trying that these districts are literally consumers of live stock rather than producers. Animals are constantly being brought in from the outside to replace those already in these areas which begin to deteriorate almost as soon as they get there and become unfit for breeding stock. Cambodia, Annam and Laos, on the other hand, have better breeding conditions and

[76] Hernandez, *loc. cit.*

produce a surplus of stock for the other provinces and for the outside world.[77]

The cattle are composed of a mixture of types and the natives practice no real system of breeding operations. About the only influence of the owners of the animals is the drafting out of the best animals for sale from the breeding herds which run wild all the year. Their feed is grass, excepting in the dry season, when the cattle live mainly on rice straw. The oxen give as an average carcass yield about 300 pounds of meat of fair quality. Fattening is seldom, if ever, completed and the meat is lean[78] Some attempts have been made to import foreign breeding stock, but the prevalence of disease and the rigors of the climatic conditions seem to make it impossible to raise European cattle or even crossbreeds with any large proportion of such blood.[79]

The breeding of pigs is considerably more systematic than that of cattle. Pigs of native breeds are kept generally and it is common in some regions for the young pigs to be bought either from native breeders or the Chinese who import young pigs from China and have the Annamites raise them on shares. The pigs roam all day around the houses looking for scraps, and are fairly well provided with feed of various descriptions.[80]

The native population is demanding an increasing amount of meat, the chief obstacle to its greater local use being its cost.[81] As a consequence, there is not only an im-

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[77] Douarche, "L'Élevage indochinois," *Congrés d'Agriculture Coloniale,* Gouvernement Général de l'Indochine, Hanoi Series, No. 10, pp. 1-63.

[78] E. A. Seillier, "Les Bovidés du Moyen-Laos et du Siam," *Bulletin agricole de l'Institut Scientifique de Saigon,* Année III, No. 7, p. 221.

[79] Douarche, *loc. cit.*

[80] H. Schein, "L'Élevage et commerce des porcs dans le Sud-Annam," *Bulletin agricole de l'Institut Scientifique de Saigon,* Année III, No. 7, pp. 220-224.

[81] Douarche, *loc. cit.*

portant amount of slaughtering for local uses, but also a considerable interprovincial trade in both cattle and hogs for slaughter.[82]

The Philippines have afforded an important market for the cattle and buffaloes in Indo-China. Cambodia has shipped as many as 31,594 head of cattle and 15,965 of buffaloes in a single year.[83] Singapore is the chief market for the pigs which are exported, for the Chinese in the Straits Settlements are busy in the mines and in commerce and must buy much of their pork.[84] Up to 1919 a regular trade of nearly 60,000 pigs was shipped.[85] In 1916 a slaughterhouse and freezing plant were established with regular refrigerated steamer service to Hongkong and Manila for the export of meats in place of the live animals.[86]

Siam

Siam lies just west of French Indo-China which it resembles in many natural characteristics. In 1923 it was reported to have 6,137,000 cattle and buffaloes and 864,000 swine.[87] The number of cattle in particular is increasing quite rapidly. It is claimed that there are large areas of land as yet uncultivated and wholly unsuited to rice growing, which is the leading crop, and that cattle raising can be expanded very readily on these lands as soon as market demands are sufficiently encouraging. As many as five or six thousand cattle have already been exported annually.[88]

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[82] Ch. Crevost, "Matières alimentaires du Tonkin," *Congrès d'Agriculture Coloniale,* Hanoi Series, No. 2, p. 14.
[83] Douarche, *loc. cit.*
[84] Schein, *loc. cit.*
[85] *Commerce international du bétail et de ses dérivés,* p. 19.
[86] *Supplement to U. S. Commerce Reports,* 54-a, 1917.
[87] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1035.
[88] Seillier, *op. cit.,* pp. 220-224.

British Malaya

British Malaya numbers among its colonies and protectorates the Straits Settlements, including Singapore and various scattered islands; the Federated Malay States of Perak, Selangor, Negri Sembilan and Pahang; the Non-Federated States of Johore, Kedah, Perlis, Kelatan and Trengganu; and British North Borneo, Brunei and Sarawak on the Island of Borneo. These scattered areas are in the tropics and, whether islands or divisions of the Malay Peninsula are all near the sea and as a rule, subject to heavy rainfall. Originally they were covered with forests and other dense vegetation. In many parts man has made a large impression on nature, and agriculture, rubber-tree cultivation and mining furnish important export products.

Many portions of these lands are well suited to the raising of live stock, considering the tropical climate, and numerous animals are raised in the crude manner customary to the natives and the Chinese who have settled there. Water buffaloes and small humped cattle are used for work purposes and for meat. Goats and sheep of mixed and primitive breeds are found, and pigs are either common or missing according to whether Chinese or Mohammedan influence is paramount in the locality. Poultry of various kinds are common.[89]

In the Straits Settlements the cattle increased from 46,000 to 67,000 and the swine from 158,000 to 267,000 from 1913 to 1919.[90] The estimated number of cattle in the Malay States (excluding Jahore) is 193,692 besides a number of buffaloes. The meat production, however, is not

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[89] Oxford Survey of the British Empire, Vol. II, *Asia*, p. 387.

[90] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 1035.

sufficient for the local needs and the domestic supply is supplemented by imports.[91]

Dutch East Indies

The Dutch East Indies cover a land area of 735,000 square miles on the Malay Archipelago. The chief islands are Sumatra, Java and Celebes, with the larger part of Borneo and about one half of New Guinea. These large islands with many small neighbors cover a belt of the world's surface on the equator south of Asia. Of these islands, Java alone has been developed to any material extent. Java has a dense human population and about 100 head of cattle, horses and pigs per square mile. The other islands have an average density of only 23 head per square mile.[92] Java and its near neighbor Madura had 5,060,000 cattle and buffaloes, 97,000 swine, 842,000 sheep and 1,421,000 goats in 1921. The other sections had 1,874,000 cattle and buffaloes, 805,000 swine, 113,000 sheep and 533,000 goats.[93] In Java the cattle industry is very important as the basis of the field work on the cultivated lands. The native cattle are small, late in development and of low fertility.[94] The conditions under which they work are probably not quite so trying as those that exist in the rice fields of Cochin China, but the production of good beef can hardly be expected. Buffaloes are also used to a large extent in field work, but their numbers have decreased through the ravages of rinderpest. The

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[91] J. R. Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 32.

[92] P. J. S. Cramer, in Proceedings of the First Pan-Pacific Food Conservation Conference, *Mid-Pacific Magazine,* January, 1925, p. 151.

[93] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1032.

[94] B. Vrijburg, "Het Veeteeltbedrijf in Indië," *Veeartsenijkundige Bladen voor Nederlandsch-Indië,* Year XXVII, Part I, pp. 7-43.

pig is an important meat animal in some sections. The Mohammedan population neither raises nor eats hogs, but the Hindus raise hogs and the Chinese are great pork eaters. Many hogs are exported to Singapore.[95]

British India

British India, including the native states under British influence, has the largest animal population of any country in the world. At the same time less economic use is made of the live stock in India than in any other important country. Religion, custom and ignorance play such a large part in the attitude towards animals that economic considerations are largely subordinated.

The number of cattle was estimated in 1924 at 146,000,000 for the whole country.[96] There are many different breeds of Indian cattle, but all of them belong to the humped race known in the western world as Zebus or Brahman cattle.[97] In addition, the latest available estimates show 44,592,000 sheep, 33,738,000 goats and 36,190,000 buffaloes.[98] The table on page 357 gives some idea of the density of cattle population as compared with that in leading countries in the occidental world.[99]

It appears that India has more cattle per unit of land used for all agricultural purposes than any of the leading occidental nations, except Holland and Belgium. Denmark and Latvia alone in Europe have a higher ratio of numbers of cattle to human beings, and in the case of Latvia the reason lies in the sparse human population.

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[95] Cramer, *loc. cit.*

[96] *Round Table*, June, 1925, pp. 522-541 (from *Proceedings of Board of Agriculture for India*), January, 1924.

[97] Sir George Watt, *The Commercial Products of India*, p. 732.

[98] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 226-236.

[99] *Ibid.*, 1909-21, pp. 237-239.

India's numbers of cattle per unit of total area are exceeded by only Belgium, Denmark, the Netherlands and French India among all the nations of the earth for which data are available.

COMPARATIVE DENSITY OF CATTLE POPULATION

Country	Cattle per Thousand Persons	Cattle per Thousand Hectares of Total Area	Cattle per Thousand Hectares of Productive Area
India, British	449.9	480.4	660.5
India, Native States		81.5	....
Denmark	792.9	602.3	639.0
Belgium	203.1	498.1	....
Germany	281.3	358.3	....
Great Britain and Ireland	251.2	378.1	451.1
United States	620.4	83.7	....

Notwithstanding these great apparent cattle resources and the shortage of food which appears periodically, India makes but little economic use of her cattle except for work and limited supplies of milk. The Hindu regards his cattle as sacred animals. The flesh may not be eaten by Hindus and the Mohammedans generally abstain. Only the bullocks may be used for labor. It is even contrary to their beliefs to sell the animals for food or to use their bones for fertilizer. Much of the manure, moreover, is wasted for agriculture, being used for fuel.[100] The bullocks are used for all agricultural labor other than that performed by the natives. They not only draw the plow, but take the place of carriage horses, operate machines for pumping water to irrigate the lands and thresh the grain by trampling over it on the threshing floors.[101]

[100] Oxford Survey of the British Empire, Vol. II, *Asia*, pp. 123, 134.
[101] Lt. Col. W. D. Gunn, *Cattle of Southern India*, Bulletin No. 60, Vol. III, Department of Agriculture, Madras, p. 3.

Some of the cows are valuable sources of milk, but most of them, even when well fed, give much less milk than European cows[102] and the cows of India as a rule are far from well fed.[103] The bullocks, being useful for work, are fed if feed is available. The cows are left to pick up what they can, and useless animals are allowed to compete for the scanty food available in the hot season. Some sections of India, notably Burma, present a much less gloomy picture. Effort has been made by the officials in various sections to improve the breeds of cattle, but ordinarily the animals roam at large in the village and the surroundings and breed indiscriminately, producing what the cattlemen of the western world would call runts.[104] Needless to say, such methods, or lack of method, in animal husbandry, produce, as a rule, poor working stock as well as poor milkers. Undernourished, ill-cared-for animals always make but small returns for the feed they do use. Since the situation is aggravated by the fact that the carcasses are wasted, as a rule, and many of the calves die or are killed without utilizing the carcass, the economic loss is appalling. The loss of calves is merely the lesser of two possible evils. Were all the calves allowed to mature, India would be more seriously overstocked than it is. As a matter of fact, most of the male buffalo calves are killed or neglected until they die.[105] The adult buffalo cows are four times as numerous as males in Bombay Presidency. On the other hand, the female calves of the cattle are neglected with the result that in the same

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[102] James Mollinson, "Dairy Farming and Dairy Produce," *Agricultural Ledger*, 1895, No. 5, p. 1, and Rao Badahar G. K. Kelkar, *Establishment and Management of the Dairy Farm*, Bulletin No. 86 of 1917, Department of Agriculture, Bombay, pp. 3, 4.

[103] G. F. Keatinge, *Note on Cattle in the Bombay Presidency*, Bulletin No. 85 of 1917, Department of Agriculture, Bombay, pp. 13-16, 24-37.

[104] Isa Tweed, *Cow-Keeping in India* (1920), p. 242.

[105] Watt, *op. cit.*, p. 736.

district there are 50 per cent more oxen than cows.[106] Obviously a large proportion of the animals is allowed to perish before it has wasted the country's substance by being raised to a fruitless adult stage. It is unfortunate that the weeding process is not more thorough, for a smaller number of better bred and better fed stock would be more useful than the present herds. It has been estimated that the "annual economic loss represented by the surplus cattle of British India amounts to over four times its yearly land revenue, and the loss in cattle which, though not 'surplus' are ineffective, is equally great."[107]

The carcasses of some few of the cattle are eaten, especially in the cities. Among India's millions are some classes of society which are neither vegetarians nor worshipers of the sacred cow. The foreigners also are free to eat the meat if the Hindu will sell the cattle. It is stated that the dairymen who produce milk in the cities for human consumption habitually sell the cows to the butchers. The carcasses so utilized are, of course, a very small proportion of the total. Apparently the only part of the worn-out animals that is nearly certain to be salvaged is the hide, which for some reason is allowed to become an article of commerce.[108] If India should ever turn her attention also to the sale of meat from the animals which are too sacred for the native consumption and should at the same time modernize her animal industry and reduce her herds to dimensions commensurate with the available fodder, she might easily have an enormous surplus for export to the outside world. Theoretically all this could be accomplished with an accompanying improvement of the soil fertility and an increase of food for the vegetarian population. However, this is one case in which theory

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[106] Keatinge, *op. cit.*, p. 9.
[107] *Round Table, loc. cit.*
[108] Watt, *op. cit.*, pp. 632-639.

and probable practice are at variance, and there is absolutely no prospect of any future contributions from India to the world's beef resources aside from the sale of Zebus as breeding stock for other semitropical lands.

The water buffalo is common in India. In 1920 it was estimated that there were 21,422,000 of these animals in the country. They are used extensively in the rice-producing regions for tillage and in localities of moderate rainfall. The buffalo is not a sacred animal, but the flesh seems not to be eaten to an appreciable extent. The cows give a fair amount of very rich milk and are prized for dairying purposes.[109] The male animals are less valuable and are usually starved or killed,[110] sometimes for food.[111]

India also has large numbers of sheep and goats and numbers of pigs in regions where religion and caste are not an obstacle to their presence. Bacon and ham are the only meats which enter foreign trade to any extent. The sheep are raised largely for their mutton, the wool being, as a rule, practically valueless.[112] The goats are somewhat more important than the sheep and are kept for their milk as well as their hair. Sheep and goats are bred on both plains and mountains. They are common all over the country and kept in the charge of a special caste.[113]

Disease is common among the animals of India.[114] Rinderpest, foot-and-mouth disease, pleuro-pneumonia and other diseases exist, but make less serious inroads among

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[109] Kelkar, *Establishment and Management of the Dairy Farm*, Bulletin No. 86 of 1917, Department of Agriculture, Bombay.

[110] Watt, *The Commercial Products of India*, p. 736.

[111] Major F. Joslen, *Cattle of the Bombay Presidency*, Bulletin No. 26, 1905, Department of Land Records and Agriculture, Bombay, p. 20.

[112] Watt, *op. cit.*, p. 747.

[113] Oxford Survey of the British Empire, Vol. II, *Asia*, p. 135.

[114] Watt, *op. cit.*, p. 742, and Tweed, *op. cit.*, pp. 313, 365.

the native cattle than they would among European cattle under the same conditions. The native cattle seem to be largely immune to these epidemic diseases. Perhaps it would be more accurate to say that the diseases affect them less severely than they do those breeds less accustomed to their ravages. An incident is told of a serious outbreak occurring in Belgium from infection from a herd of apparently healthy Zebus which were being transshipped through a Belgian port. While apparently healthy, the Indian cattle communicated disease to Belgian cattle in the near vicinity.

India is generally supposed to be overpopulated and one of the chief examples of a land where the agricultural possibilities are unequal to the support of the inhabitants. However, the density of human population is not great. India as a whole has only 68.5 persons per square kilometer, while France has 71.2 and Germany has 127.4 who were abundantly nourished with the help of only 20 per cent of imported food in the days of peace. The soil of India is fertile and, but for periodic drouths, very fruitful. Her standards of agricultural production are so low, however, that the population is undernourished. One of the greatest reasons for this unhappy state of affairs is the grossly mismanaged animal husbandry. The animals which should be an aid to man's sustenance are in reality to a very large extent competitors for the food which man should have, and the religious veneration in which the beasts are held allows them actually to destroy much that might otherwise contribute to human well-being.

Ceylon

Ceylon, which lies to the south of India, partakes of many of the characteristics of that country as regards live stock, although it is even more subject to tropical

influence. The Zebu race of cattle and water buffaloes are kept chiefly for draught purposes, with meat production assuming perhaps a larger importance, owing to the preponderance of the Mohammedan and other non-Hindu population. Sheep, goats and pigs are also kept for meat. There is a fairly large import trade in live animals from India and there are also considerable imports of frozen and canned meats. There is a tendency now to encourage the live-stock industry by prevention of disease and other measures.[115]

Western Asia

In the lands west of India and south of a line drawn between Syria, the Caspian Sea and Turkestan, the meat-producing industry affords little of interest to the outside world. Cattle are kept only to a limited extent and those mainly in parts where settled agriculture exists. Sheep and goats are common, but the religion of the Mohammedans, who inhabit all these countries, makes the pig a rare animal. Most of this section of the world is arid. Parts of the deserts receive enough rainfall at certain seasons of the year to afford considerable grazing to numerous flocks of sheep and goats which are the mainstay of the nomadic population. In the dry seasons the flocks are driven as a rule to better-watered sections. Some of the mountainous sections and part of the coastlands have a fair rainfall and the inhabitants have learned to make very careful use of the supply of water. In such places the true agriculture of the country is conducted, and in some places, such as in Afghanistan, alfalfa is grown for cattle in intensive conditions under irrigation. Much of the Tigris and Euphrates valleys in Mesopotamia may

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[115] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 31.

be irrigated eventually and when this is done this section should be very productive.[116] At present Mesopotamia exports considerable numbers of sheep and goats to Syria.[117] The main contribution of the live stock of this whole region consists in hides and skins and the rugs woven from the coarse wool and hair from the flocks. The British possession of Aden in the extreme southwest of Arabia imports considerable live stock from the neighboring sections of Africa.[118]

Palestine has 110,000 cattle, 262,000 sheep and 482,000 goats and practically no pigs. Syria has 293,000 cattle, 1,092,000 sheep and 1,316,000 goats.[119] The cattle are similar to those of Lower Egypt, but rather more developed. The cows seldom give a carcass weight of as much as 220 pounds. The best cattle are found in the Damascus region. Sheep are kept by both the settled and nomadic portions of the population and goats are more numerous than the sheep. In the south of Palestine the sheep are very large with a fine quality of flesh except for its strong odor. The settled population graze their flocks on the fallow land and stubble near the villages, while the nomads let their flocks feed in the desert in the winter and spring when there is feed for them and invade the lands of the agriculturists in the summer. In Syria, in addition to mountainous areas, there are regions with meadows that are nearly or altogether perennial and can be pastured during the greater part of the year. Seasonal migration is followed to a certain extent, some flocks grazing in the plains in winter and in the mountains in

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[116] Suleiman Sirri Bey, in *Modern Turkey,* by E. G. Mears, pp. 265-279.

[117] *Supplement to U. S. Commerce Reports,* "Syria," 1922, p. 7.

[118] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, pp. 27-28.

[119] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, pp. 1034-1036.

the summer.[120] The effect of the war on the flocks of these regions was disastrous. Syria has both an import and an export trade in sheep and goats, the former coming from Anatolia and Mesopotamia, and she also exports cattle. The imports at Aleppo for the first 10 months of 1922 included 268,600 sheep, 92,000 goats, 77,800 lambs and 4,708 cattle. During the same period, 43,251 sheep, 20,617 goats and 48,980 lambs were slaughtered at Aleppo.[121]

Turkey in its present reduced area is mountainous to a considerable extent. Nevertheless, much of the land is rich and capable of greatly increased agricultural development. At present most of the lands lie fallow or are used for rough grazing. Unsettled political conditions for many ages and the rapacity of tax gatherers have tended to rob the population of what modest supplies of initiative they ever possessed for making permanent improvements in the land. Irrigation has been practiced to a limited extent since the days of the prehistoric Hittites, but its possibilities are to-day developed only to a very limited extent.[122] Only about three million out of a possible thirteen million hectares of land are cultivated. Nevertheless, agriculture and stock raising, of a sort little changed during the past two thousand years, are the main occupations of the people. The war destroyed many of the animals, but it is estimated that there were 4,621,929 cattle, 11,443,503 sheep and 10,008,806 goats in Asiatic and European Turkey combined, in 1925. The number of goats seems to have suffered most during war times. Many of these latter animals belong to the Angora breed which

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[120] Ed. Dechambre, "Aperçu sur les animaux domestiques de Syrie," *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 29, pp. 975-976, 995, 1002. Haut Commissariat de la République Française en Syrie et au Liban, *Notes sur l'élevage du mouton en Syrie et en Cilicie*, 1921.

[121] *Supplement to U. S. Commerce Reports*, "Syria," 1922.

[122] Suleiman Sirri Bey, *op. cit.*

is famous for the hair used for the production of mohair, but the flesh of these animals is also very popular. Large areas of the country are suitable only for grazing. The mountain sides are used for goats. The level stretches in the interior produce sheep and the grassy valleys are used for raising cattle. The meat products are mostly consumed locally, but flocks of sheep and goats are driven long distances from the grazing lands to the market centers and a few live cattle and sheep are exported, mostly to Egypt.[123]

The Island of Cyprus had 51,536 cattle, 266,141 sheep and 169,249 goats in 1921. The native cattle are small like Jerseys and beef is used but little. The sheep belong to the fat-tail race which covers all eastern Asia. The goats also belong to the native unimproved breed. Pigs exist in the Island, but the native breed is poor and matures slowly. Recently large Blacks have been introduced and are doing well. The industry of Cyprus has been improved during the past decade since the establishment of a government stock farm.[124]

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[123] C. Manetti, "Le Capre del Mediterraneo," *L'Agricoltura coloniale*, Vol. XIV, No. 9, pp. 367-376; E. F. Nickoley, in *Modern Turkey*, by E. G. Mears, pp. 280-301.

[124] Ainsworth-Davis, *loc. cit.*

CHAPTER IX

AFRICA

Africa contains the site of part of the world's earliest civilization, but is one of the last parts of the earth to be conquered by modern civilization.

Most of the northern portion of the continent is dry, a large part being actual desert. The torrid zone passes through the center and but little of the south is in the temperate zone. Nevertheless, much of the center and most of the tropical south are sufficiently elevated to render it habitable by the white man and meat-producing animals. One great handicap in many sections is the presence of diseases which are particularly severe on both man and beast in the tropics. These are at their worst in the tropical lowlands, but there is a tendency for some of the most destructive diseases to spread into the better regions in the form of epidemics. The diseases borne by the tsetse fly and its relatives, which affect both man and beast, are distinctly African. Since the war the Germans have discovered what promises to be a cure for this type of disease. Dipping and inoculation have proved fairly satisfactory defenses against some of the other serious diseases and it is claimed that recent investigations have produced still other remedies for the tropical ills of both man and beast. However, the cleaning out of disease in certain isolated regions seems not to be wholly satisfactory. So long as there are great centers of disease left beyond the reach of civilization, with wild game present to aid in the spreading of infection, it will be difficult to

maintain an effective quarantine. Modern science is making great strides toward the subjugation of the tropics, and if the present rate of progress is maintained Africa will soon be largely open to the development of an animal industry of a productive type.

The Union of South Africa

British South Africa has been open to the commerce of civilization for centuries, but her meat-producing industry still holds a comparatively unimportant position. It is a striking fact that Australia, which was discovered much later than South Africa, which is farther from the European markets and has worse climatic conditions, has developed before this latter country as an important source of agricultural and live-stock products. It is only within the past decade that South Africa has become an exporter of meats, and yet she has very extensive possibilities of fair quality for the development of an important meat trade and was relied upon as a source of meat for the shipping trade of the Dutch in the seventeenth century. Stock diseases and the ravages of war have had their influence in retarding the growth of the animal industries, but back of these there appears to be a stronger economic reason for the slow development. In the words of the Dominions Royal Commission: "The extraordinary progress of mining in South Africa has overshadowed the development of agriculture; first the diamond fields, and then the gold fields have offered more immediate prospects of gain than the slower and more sober agricultural pursuits. It may even be said that steady agriculture has also an enemy in its own house in the shape of ostrich farming."[1] It

[1] P. J. v. d. H. Schreuder, *Notes on the Export Trade in South African Beef*, Department of Agriculture, U. of S. A., 1917, p. 1; Dominions Royal Commission, *Third Interim Report*, 1914, Cd. 7505, p. 27.

must also be remembered that the Union has a very large negro population.

The Union of South Africa, which consists of the old British Cape Colony and Natal and the former Dutch republics of the Orange Free State and the Transvaal, occupies the southern tip of Africa. Very little of this country is within the tropics and the high elevation of all but the coast assures a very moderate amount of heat all over the country. Lack of rainfall proves a serious handicap to a large part of the territory. Aridity, however, is not nearly so serious as in Australia. The land elevation, as in this latter country, is unfavorable to securing the most rainfall out of the prevailing winds, but the conditions are not so extreme. The country rises from the seacoast in a series of plateaus bordered by ranges which are escarpments rather than mountains. Since the highest land is relatively near to the southeast coast and the slope is away from the rain-bearing winds, much of the interior receives less water than would be desirable for farming operations. Toward the west the rainfall is distinctly deficient and the desert of Kalahari stretches northward from the Orange River Valley through Bechuanaland Protectorate. In the south also, a region, called the Great Karroo, is so thoroughly cut off from the rains by a coastal range that it is a desert. Speaking in general terms, the western third of the country, with the exception of a coastal strip of less than a hundred miles in width, has less than ten inches of annual rainfall. Needless to say, agriculture is not carried on extensively in this section and sheep and goat grazing predominates. A belt of land just east of this and much of the southwestern coast have less than twenty inches of rain and while but indifferent farming territory, are better land for stock. The eastern section, which widens out toward the north, has an ample rainfall for either agriculture or grazing.

There are but few mountains to interfere with the development of the live-stock industry and the comparative dryness has not encouraged any great growth of forests. Probably fires lit by the natives also checked the growth of trees and prepared a covering of grass and other fodder for stock on the vast plains. Unfortunately, frequent burning has hurt the quality of the grass and probably decreased the fertility of the soil. On the higher plains toward the east there is plenty of native grass of fairly good quality which affords excellent grazing during the summer rains. While the winter may bring frosts, it does not cover the ground with snow as in some countries. In the interior, however, the winter is dry and the grass dies. The fact that the dried grass remains uncovered in the fields probably has served to discourage the proper development of winter forage. Toward the west the grass tends to disappear and its place to be taken by shrubs and other vegetation capable of resisting drouth.[2] Prominent among these growths is that of the prickly pear, spineless varieties of which are useful as forage.[3] Much of this vegetation is suitable for the use of the Merino sheep and Angora goats. Unfortunately, whether owing to repeated burnings or a real natural deficiency in the soil, much of the vegetation is deficient in phosphorous and the cattle frequently suffer from dietary deficiency diseases in consequence.[4]

Indian corn is grown very extensively in several sections of the east, particularly in a large triangular area in the north and center of the Orange Free State and the south of the Transvaal. This grain is used largely as human food and is also exported, but it affords a great

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[2] Oxford Survey of the British Empire, Vol. III, *Africa*, pp. 3-66.

[3] *Journal of the Department of Agriculture*, U. of S. A., February, 1924, pp. 256-260.

[4] *Ibid.*, May, 1924, pp. 460-504.

potential supply of forage for winter feeding and the fattening of stock. Kaffir corn and other sorghums are grown extensively, especially in the drier sections. Alfalfa is also grown successfully over wide areas and should eventually be a very important basis for animal husbandry. At present its growth is on irrigable land and covers only 142,000 acres.[5] The native grasses which flourish in the rainy summer and dry up in the winter leave much to be desired, and some successful efforts have been made to establish artificial pastures.[6]

The basis for most of the cattle herds and many of the flocks of sheep was the stock kept by the native Negro population before the advent of the whites. The Afrikander cattle in common with the native stock all over the continent are related to the cattle of southern Asia, the humped *Bos Indicus.* The hump is not prominent and fails to appear in some strains, but there seems to be good reason to support the idea that all these cattle had a common origin. How much blood from European cattle may have been introduced before the modern importation of stock by the British settlers is a matter of some dispute, but it appears probable that the Afrikander cattle of the Boer farmers were merely the cattle of the natives somewhat improved by better selection and care. They were used chiefly by the Boers for draught purposes.[7] The sheep of the early days were the fat-tailed woolless sheep found in many parts of the continent of Africa. Millions of them still remain, but the Dutch began their improvement by the importation of European breeding stock at an early date. The English in more recent times

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[5] *Ibid.*, February, 1924, pp. 129-138, 163-172.

[6] Oxford Survey of the British Empire, Vol. III, *Africa*, p. 103.

[7] *Live Stock Journal*, Jan. 2, 1925, p. 18; T. G. W. Reinecke, "Afrikander Cattle," *Cattle Breeding*, Proceedings of the Scottish Cattle Breeding Conference, 1924, pp. 440-453.

have done much to build up flocks of highly efficient wool-bearing Merinos and have brought in some of the English breeds.[8]

It is impossible to determine the exact number of live stock in the country before the Boer War. Statistics for the early days are nonexistent. Apparently, however, in the early nineties the country was fairly well stocked.[9] About 1896 a very serious epidemic of rinderpest depleted the herds. Following this the war wiped out the flocks and herds over wide areas. Soon after peace was restored, tick-borne diseases secured a hold on the animals that were left. At first the attempt was made to stamp out these diseases by destroying the affected herds. Science and threatened rebellion on the part of the natives, who attach particular importance to their cattle, combined to change this campaign into one of dipping the animals in solutions which kill the insects without injury to the stock. In the decade before the World War the stock was built up in both quantity and quality. There is some question as to whether the numbers had reached previous levels, but the exports during the war indicate that the meat production was distinctly greater than ever before. The basis for one of the serious animal diseases of the country, and the means for its cure, have been discovered recently. This disease is *lamziekte.* It is a secondary result of a lack of phosphorus in the feed and finds a ready cure in an ample supply of phosphorus either in the form of bone-meal or otherwise. Experiments leading to the control of the disease have shown clearly that other less critical, but very far-reaching results of the deficiency of this element may be done away with at the same time and

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[8] *Journal of the Department of Agriculture,* U. of S. A., February, 1924, pp. 221-229.

[9] Dominions Royal Commission, *Minutes of Evidence Taken in the U. of S. A. in 1914,* Part I, p. 180, Cd. 7706.

that an artificial supply of phosphorus adds materially to the efficiency of the animals in producing meat.[10]

Between the South African and the European wars much was done to build up the quality of the stock in the country. The Boers and the native blacks retain the Afrikander cattle, but the British settlers are importing English cattle and Frisians. Unfortunately, no real system of stock improvement seems to have been perfected. The prevalence of disease and the rigors of the dry season make the hardiness of the Afrikander cattle very important, but these are poor meat producers. European stock has to become acclimated and either kept from disease or made immune to it. It appears that the first cross between native and imported stock is very satisfactory, but that successive generations deteriorate under the breeding systems, or lack of system, in general use. A very great deal remains yet to be done before South Africa has as efficient meat-producing stock in general use as the Argentine. Nevertheless, progress is being made under government leadership and even the cattle of the native blacks are being gradually cleared of disease. It is a question, however, if the disease problem can be fully controlled before the wild animals of the country are finally destroyed or else thoroughly isolated.[11]

The improvement of the flocks of sheep has been carried much further than that of the herds of cattle. This is probably due to the fact that the best sheep country is relatively dry and less subject to disease than the cattle country. It also is true that serious efforts to improve the sheep breeds have been in progress very much longer than those to improve the cattle. At present the great

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[10] *Journal of the Department of Agriculture,* U. of S. A., February, 1924, pp. 256-260.

[11] Dominions Royal Commission, *op. cit.*, pp. 178, 181, 208-210, 239, etc.

majority of the sheep are Merinos. There are several million native non-wool-bearing sheep [12] and only a very few of the British mutton breeds.

It is only in the last decade that there has been any export of meat. Formerly cattle were kept for domestic consumption, for dairying and for draught purposes. Sheep are still kept mainly for wool. Since the South African war the intent has been to build up herds for the export of meat, but the country did not become more than self-sufficient in meat production until 1914.

Naturally there has been a large domestic consumption by the white population. The amount consumed by the blacks when employed by the whites is fairly large. Those employed in the Kimberly mines who purchase their own food eat about 128 pounds a year per adult man while the ration supplied the blacks in the Witwatersrand mines is about 172 pounds.[13] However, there are many blacks living under native conditions and these eat little meat. Since these are a very large element in the total population, the average per capita consumption for the whole population is low. It is estimated to amount to 31.3 pounds of beef, 22.8 pounds of mutton and lamb and 1.1 pounds of bacon and ham.[14]

Immediately before the World War, South Africa imported considerable quantities of beef. An outstanding year for this trade was 1912, in which year 9,023,605 pounds were imported. With the advent of war the imports practically disappeared and exports began to assume importance. The years of greatest exports were 1917 and 1919 with 49,997,410 and 46,363,180 pounds respectively.[15] The heaviest

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[12] *Journal of the Department of Agriculture,* U. of S. A., February, 1924, pp. 221-229.

[13] *Official Year Book,* U. of S. A., 1910-22, p. 980.

[14] Report of U. S. Trade Commissioner, Perry J. Stevenson, Johannesburg, April 27, 1926.

[15] *Official Yearbook,* 1910-24, p. 407.

shipments during the war were to Egypt [16] where we may assume that the meat was consumed by the military forces. Since the war exceptionally dry seasons affected the supply and this, coupled with a poor international demand, caused a decline in export to less than a million pounds a year. In 1924, however, nearly eight and a half million pounds were exported. The quality is as a rule too poor for the British market and most of the shipments usually find their way to the Continent.[17] There is no important trade in mutton and lamb. There may eventually be an important export of pork products, but the amount of such products so far exported in a single year has only once exceeded a million pounds. In 1919, 1,424,942 pounds were exported. Usually the imports are nearly as great as the exports.[18]

Estimates are available for the live stock in the year 1924. These show 9,606,274 head of cattle and 32,002,848 head of sheep in the Union. In addition, there are over eight million goats, many of which are excellent mohair-yielding Angoras, and nearly a million pigs.[19] In spite of the fact that the western half of the country is typical ranch land, being good for little or nothing else under present agricultural technique, most of the cattle are in the eastern portion. Dispersion maps show a fairly even distribution of cattle in the eastern third, tending to decrease in the north of the Transvaal, and comparatively few in the lands having less than twenty inches of rainfall. The eastern part of the Great Karroo is practically devoid of cattle and but few appear north of the Orange River in the Kalahari district. The moist sec-

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[16] *Commerce international du bétail et de ses dérivés*, p. 85.

[17] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1924, p. 15.

[18] *Foreign Crops and Markets*, July 25, 1923, p. 105.

[19] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 220-235.

tions of the south coast have a few cattle. The dispersion of sheep and goats is somewhat more even, but here also the moist eastern section has a greater density of stock than the drier west.[20] There is a tendency to run goats on the more arid sections, particularly on the Karroo, while the sheep are more important in the more favored districts.[21]

The live-stock industry of South Africa is still largely in the extensive ranching stage. Until near the end of the first decade of this century winter feeding of the animals was practically unknown and the ranches kept no more stock than could be maintained on the dried-up grass on the open veld in the winter. The ranches were large and the cattle often had to roam for many miles in search of water. Fences were hard to maintain, for the wild beasts frequently destroyed them. To protect the cattle and sheep against the attacks of carnivorous animals they were enclosed at night in a kraal, although night feeding is frequently the best. While grazing they were tended by black boys on foot. This old system has by no means been entirely outgrown. However, there is now a tendency toward more productive methods. Fencing is common, although it still is subject to destruction by the wild beasts in the Transvaal.[22] Water is now frequently provided from wells instead of the natural watering places frequented by wild animals contaminated by disease. Winter feed is also provided in many parts of the more settled regions. Even before the war most of the farmers in the more highly developed regions provided rye or other winter feed. The larger ranches of the older districts are now also being broken up into smaller farms.

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[20] *Official Year Book*, U. of S. A., 1910-22, map inserts, p. 512.
[21] *Journal of the Department of Agriculture*, U. of S. A., February, 1924, pp. 230-237.
[22] *Ibid.*, May, 1924, pp. 508-517.

Sheep raising is giving way to dairying which is increasing fairly rapidly, but mainly for the domestic market. Nevertheless, it would not be correct to say that farming in South Africa was becoming intensive. It is merely becoming less wastefully extensive. Some of the best local authorities assert that it can never become a land of small holdings. Certainly the drier western sections cannot be intensified without irrigation under present known agricultural technique and there seems little prospect of any immediate move toward intensive conditions even in the east.[23]

The provision of supplies of winter feed can certainly increase the carrying capacity of the country greatly. Better breeding systems and provisions against deficiency in the diet can also do much to increase the output.[24] Almost the whole eastern section of the veld and most of the coast can grow corn successfully. Part, at best, of the stover from this corn is now undoubtedly eaten by the live stock, but the fattening of cattle on corn is a thing spoken of chiefly for the future. The live-stock possibilities of the country are ultimately very great. The west is well suited to raising young stock for "feeders" or "stores" and the east can readily take a place in finishing these animals on corn similar to that held by the Corn Belt in the United States. The corn-growing possibilities of this district are large, and there is a vast hinterland to the north as well as the west which is under the British flag and more or less closely associated politically with the Union, which is capable of becoming a copious reservoir of feeders. Disease is a barrier to rapid progress and the problem of disease is related to that of better breeds. A disease resisting strain of cattle

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[23] Dominions Royal Commission, *op. cit.*, pp. 10, 20, 241, 269, etc.
[24] *Journal of the Department of Agriculture*, February, 1924, pp. 256-260; May, 1924, pp. 508-517.

that would also be an efficient meat producer would work wonders for South Africa, but so far this problem has not been attacked as the Danes and New Zealanders have attacked, and solved, their problems of breeds suited to peculiar geographical conditions. Eventually the problem will be solved in some manner when the market demands warrant the effort. The corn areas also can readily produce great quantities of pork. So far, South Africa fits her live-stock production mainly to her domestic market and gives her best attention to her mines. The problem of the native population is also a very real hindrance to agricultural progress. However, the natural resources are present when the world's need demands their full exploitation.

Basutoland

Basutoland is a native state under British political administration occupying an area of 11,716 square miles within the confines of the Union of South Africa. It is said to be overstocked with live stock and in 1921 had 580,666 cattle, 1,859,712 sheep and 895,358 goats. The breeds are being improved to a certain extent and the export of live stock and animal products to the Union is fairly important.[25]

Swaziland

This native state lying between the Transvaal Province and Portuguese East Africa is under British control. It has an area of 6,678 square miles. The interior of the country is similar to the best of the South African veld and is an excellent cattle country, but toward the coast the country is lower, wetter and more subject to disease.

It is estimated that before the epidemic of rinderpest

[25] *Official Year Book of the Union of South Africa,* 1910-22, pp. 1027, 1028.

in the last century this country had 300,000 cattle. In 1911 there were only 57,601 cattle, but by 1922 the number was approximately 225,000, most of which belonged to the native breeds. In spite of the fact that this is a native province, dipping of the cattle is compulsory and its value is recognized by blacks as well as whites. Pure-bred stock is also being introduced to a considerable extent to mix with the native breed. These are being brought in by the European ranchmen who hold extensive concessions, the largest of which runs about 12,000 head of cattle. There are estimated to be about 9,000 pigs in the country and 160,900 native sheep and goats. In addition, about 300,000 sheep are driven into the country each year for winter grazing. In 1922, 5,179 head of cattle were exported to the Union for slaughter purposes. The trade in other cattle is prohibited.[26]

Southwest Africa

Southwest Africa was taken from the Germans in 1915 and is now administered by the Union of South Africa under mandate from the League of Nations.

The coastal region of this country is a barren desert where water for human consumption was at one time imported from Cape Colony.[27] Inland, on the higher regions, there is a moderate rainfall and a considerable native and animal population. The rainfall is not sufficient for any great agricultural development, but, with the aid of well water, live stock can be maintained on ranch conditions. Fortunately, well water is easily procured, as there are large areas with ample supplies of underground water. Drinking water for the stock is also conserved by means

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[26] *Official Year Book of the Union of South Africa,* 1910-22, p. 1057.

[27] Oxford Survey of the British Empire, Vol. III, *Africa,* p. 463.

of dams. The natives are naturally pastoralists and under proper supervision may produce a real surplus of meat animals to be fattened in South Africa. Under the German administration the native breeds of stock were improved. Emphasis was laid on scientific methods of production and new breeds were introduced, particularly the Karakul sheep.[28] The southern part of the country is the driest and is best suited to sheep or goats. The central and northern portions are better fitted to cattle. The production of meat animals is already more than sufficient for local needs and the territory supplies cattle and other stock to the Union.[29] It is estimated that there are about 400,000 cattle and two and a half to three million head of small stock.[30] The lack of water will always stand in the way of intensive production and, unless alfalfa can be cultivated extensively, the live-stock industry will always be distinctly on the extensive scale.[31] With proper organization, however, it can eventually supply a material surplus to finishing farms in the Union.

Bechuanaland Protectorate

The Bechuanaland Protectorate lies in the very heart of the southern part of Africa north of the Union. Its area is estimated to be about 275,000 square miles, much of which is at least fair stock country. Its average elevation is supposed to be about 3,300 feet above sea level. The rainfall is moderate but the soil is mostly sandy and very little water flows out of the country. The eastern portion is hilly, but most of the country is nearly flat and is described as "undulating, rich in grasses, shrubs and

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[28] *U. S. Commerce Reports,* May 5, 1917, p. 1064.
[29] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Part II, p. 43.
[30] *The Statesman's Year-Book,* 1925, p. 269.
[31] *U. S. Commerce Reports,* April-June, 1919, p. 1207.

trees." Aside from a few rivers and marshes, there is practically no surface water in the country excepting in the wet season. In the dry season, water can usually be obtained by sinking wells in the sandy beds of the larger rivers. In the east, boring for water gives good results in some places. In the west in the so-called Kalahari Desert, only meager results have been obtained in the attempt to sink wells. Some authorities believe that even there deep boring will supply the drinking water which is the limiting factor at present for development.

Here, as elsewhere, the epidemics of animal diseases in earlier years destroyed the herds. It is estimated that rinderpest swept off 95 per cent of the cattle. In 1921, the country had 495,000 cattle, 132,000 sheep and 248,000 goats, most of which were owned by the natives. Disease has been common and has stood in the way not only of increasing the herds but also of exporting the surplus. For a time the Union government allowed only slaughtering stock moving in sealed cars to the abattoirs to be shipped into the Union. Recently it has been recognized that the Southern Protectorate is clean cattle country and exports have been allowed subject to quarantine provisions.[32] This country should eventually be a good source of feeding stock for corn farms in the Union.

Southern Rhodesia

Southern Rhodesia is an extension of the South African plateau northward into the tropics as far as to the Zambesi River. The surface of the country is rolling and lies at a general level of 3,000 to 5,000 feet above the sea, with somewhat lower levels near the rivers on the northern and southern borders. The altitude saves all but the val-

[32] *Official Year Book of the Union of South Africa,* 1910-22, pp. 1022, 1038.

leys from a real tropical climate and the country has been found to be well adapted to the needs of a white population. The rainfall, as a rule, is greater and more certain than that of the Union of South Africa. In the drier sections somewhat less than 20 inches falls in a year, but most of the country gets nearer twice that much water. The so-called winter, which sees nothing colder than a few degrees of frost, is generally dry, but streams and wells afford ample water for the stock.

It is estimated that 144,800 square miles out of the total area of 153,247 miles is readily fit for grazing. Presence of the tsetse fly in the lower-lying lands accounts for most of the land not yet counted as fit for stock.[33] None of the land classed as cattle country has the fly, and at present, disease is not a very serious factor confronting the industry. The epidemic of rinderpest that spread all over southern Africa in 1896 visited this part of the country in its course and the later wave of East Coast fever brought its ravages. Now the native cattle are troubled but little with serious diseases, although red-water fever and some other diseases are present and present a problem in the introduction of European purebred stock.[34] The country is not yet free from destructive wild beasts.

The country is generally covered with grass. The higher land has many trees, but these are not sufficiently dense to interfere seriously with the growth of the grass and they afford shade to the animals. Only in limited areas is it necessary to get rid of the trees to improve the pasture. The native grasses are described as "sweet veld" and "sour veld." The latter appears not to be especially suited to the requirements of the imported breeds of cattle. Both types are found on all classes of soils. The area classed

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[33] "Memorandum on the Cattle Industry of Southern Rhodesia," published in the *Rhodesia Agricultural Journal*, 1921, pp. 242-246.
[34] *Ibid.*, pp. 275, 276.

as "sweet veld" increases rapidly with regular stocking without too close grazing and the increase is greatly assisted by stopping the grass fires which have occurred regularly since before the white man's appearance. The grasses are usually tufted, but give a continuous turf when properly cared for and saved from fire. In the dry season the grass dries up, but the "sweet veld" retains its nourishing qualities to a large degree.[35]

The basis of the present herds is the original cattle of the natives. These cattle are fairly similar to the Afrikander stock of the Union. They are hardy and fit the difficulties of the country, but they are poor meat producers, the carcass being light, poor in quality and not readily fattened. Since the British settlers have come in, there has been a marked move to bring in English breeds of beef cattle. As a consequence, there is a large proportion of grade cattle in the country. There is a great controversy over the question of the proper system of breeding to fit the needs of the country. The ideal would be the hardiness of the native stock and the efficiency of the English breeds. This has not yet been found in any breed or cross and no new type has been evolved locally to fit the needs of the country as the Corriedale sheep fit the needs of the New Zealand sheep industry.[36] There are now nearly two million cattle in the country. In 1923, there were 1,920,951 head, of which 993,608 were owned by Europeans and the remainder by natives.[37] Unfortunately the natives are exceedingly slow to introduce better stock and better methods of caring for the stock, although they are showing some signs of following the practices of their white neighbors. From the standpoint of the live-stock industry it is fortunate that only 20 per

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[35] *Ibid.*, pp. 242-246.
[36] *Ibid.*, pp. 258-267.
[37] *Rhodesia Agricultural Journal*, December, 1924, p. 682.

cent of the land is reserved for the exclusive use of the native population.[38]

The principal method of handling cattle is the same as that in vogue in the Union and taken originally from the natives: herding by day under the care of natives and confining in a kraal by night. This system has its advantages in a country where carnivorous beasts are still a serious problem and herds of other wild animals destroy fences at night when attacked by lions. However, the system has many drawbacks and the ranchers run their cattle in fenced paddocks when such a system is practicable. Winter feeding is also becoming more common. Hay can readily be made from the native grasses and this whole country is admirably suited to the growing of corn, or "mealies" as it is called locally. The corn is fed both as grain and in the form of ensilage. Owing to the fact that an attempt is being made to develop cotton production, it is anticipated that eventually cottonseed cake will prove a valuable fattening ration. Fattening is easily possible on grass alone when the animals are finished during the summer months. Artificial feeding in pens or kraals is beginning to be practiced, but is not common as yet. The native cattle do not respond favorably to artificial fattening, but there is an increasing tendency to fatten the grade animals either on grass or artificial feeds.[39]

Local consumption took all the available supplies of meat until about a decade ago. The estimates made of local consumption are interesting, not only as a direct item in the local industry, but also because they shed light on the meat-consuming habits of the native blacks. The fol-

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[38] "Memorandum on the Cattle Industry of Southern Rhodesia," published in the *Rhodesia Agricultural Journal*, 1921, p. 248.

[39] *Rhodesia Agricultural Journal*, December, 1924, p. 708; "Memorandum on the Cattle Industry of Southern Rhodesia," published in the *Rhodesia Agricultural Journal*, 1921, pp. 268-272.

lowing table was presented by the national committee which analyzed the status of the cattle industry in 1921. It is evident that contact with European standards of living increases the rate of native consumption.

BEEF CONSUMPTION IN SOUTHERN RHODESIA[40]

Beef Consumed	Pounds
40,000 Europeans at 150 lbs. each per annum	6,000,000
800,000 natives in kraals at 20 lbs. each per annum	16,000,000
40,000 natives on rations at 100 lbs. each per annum	4,000,000
40,000 natives supplementary at 50 lbs. each per annum	2,000,000
10,000 natives in towns at 100 lbs. each per annum	1,000,000
TOTAL	29,000,000

The following information is given in a recent report from the United States Trade Commissioner at Johannesburg.

The local consumption by the white population in 1925, exclusive of live stock slaughtered for consumption on farms, was as follows:

Cattle	65,000 head
Sheep	26,681 head
Slaughter pigs	11,612 head

About 56 per cent of the pigs slaughtered were converted into bacon and ham, 546,741 pounds exclusive of that home cured on farms, being manufactured in the Colony in 1925. The following is the record of imports and exports of bacon and ham during the past four years:

Year	Imports in Pounds	Exports in Pounds
1922	74,783	108,992
1923	126,054	76,531
1924	66,092	156,526
1925*	90,349	85,528

* January to October.

[40] *Rhodesia Agricultural Journal*, 1921, p. 296.

Exports of cattle for the year totalled 60,543 head. Of this total 58.9 per cent went to the Imperial Cold Storage Company, 23.8 per cent to the Congo, and 15.8 per cent to the Johannesburg market. 1,125 head of cattle for breeding purposes were imported during the year.

The number of sheep owned by the European colony is relatively small and of the 26,681 slaughtered for domestic use fully 50 per cent were imported. An important factor always to be considered is that Kaffir stock—cattle, sheep, pigs and goats—although considerably in excess of the European holdings are never drawn on for export or for local consumption except by the native population.[41]

Before the World War the foreign trade consisted of imports of meats and live animals to build up the local herds. Oxen were also imported from the countries to the north. In 1916, the tide turned definitely outward and the exports assumed considerable importance. Most of the exports have been to the Union of South Africa for slaughter. Since Rhodesia is wholly an inland country the exports must all be made by rail. Presence of "fly belts" and other natural difficulties render it impracticable to drive the cattle to the southern markets on foot. Fortunately, for a new land, the country is well provided with rail-shipment facilities for export either through South Africa or through Portuguese East Africa.[42] At present there are no facilities for slaughtering locally for the frozen-meat trade and cattle going into this trade are shipped south alive. There is a canning factory in the country, but it has stopped operating since the war.[43] Some animals are sold to Portuguese East Africa and now that embargoes have been removed, shipments, doubtless, will be made to the Belgian Congo, with which there is a

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[41] Report of U. S. Trade Commissioner, Perry J. Stevenson, Johannesburg, July 12, 1926.

[42] *Rhodesia Agricultural Journal*, 1921, pp. 256, 277, 288, 290, 291.

[43] *Ibid.*, pp. 303-310.

good rail connection.[44] The recent state of the world's meat markets and the poor character of the bulk of the cattle ready for sale in Rhodesia have checked any rapid development of exports since the war. There is every reason to believe that it will be a matter of only a few years until there will be a surplus of cattle of fair quality some of which will do for the British market and others for the continental trade.

It is estimated that by 1937 the country will maintain about nine million head of cattle with the general use of some winter feeding to supplement the range.[45] It is not likely that intensive methods of production in close relation to high-class farming will be introduced soon enough to increase these estimates for the near future.

In addition to cattle, Southern Rhodesia had 331,273 sheep, 802,189 goats and 65,219 pigs in 1921. It is claimed that the character of the grazing is such that it should be grazed for a number of years by cattle before the sheep are introduced.[46] The native flocks are now being improved by the import of purebred rams. The natural facilities for raising corn should in time provide a basis for an important swine industry.

Northern Rhodesia

Northern Rhodesia is similar in its general characteristics to Southern Rhodesia, excepting that it is nearer the equator. It has the same high elevation, but its lower latitude makes the climate more nearly tropical. Apparently it has a more favorable amount of water than some parts of its southern neighbor. It also has more tropical

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[44] *Rhodesia Agricultural Journal,* October, 1924, p. 518.

[45] "Memorandum on the Cattle Industry of Southern Rhodesia," published in the *Rhodesia Agricultural Journal,* 1921, p. 241.

[46] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series (1924), Vol. I, Part II, p. 45.

vegetation, particularly in the case of hardwood trees, but the forests are thin and eventually most of this country of 291,000 square miles will be available for the development of the live-stock industries and agriculture.[47]

This country as yet has received very little development. It is still under the administration of the South Africa Company. A considerable area is infested by tsetse flies and in consequence is not fit for either man or beast under present conditions.[48] Nevertheless, herds of cattle, sheep and goats are being built up and improved, and railway communication connects with the Congo as well as British South Africa. Needless to say, disease is still common and the cattle are small and thin and slow in maturing. It is said the average slaughtered weight is not above 300 pounds.

The Belgian Congo has afforded the chief market for surplus stock and the development of the mines in that country is expected to increase this market outlet. Until recently the authorities in charge of Northern Rhodesia, having control of the only rail connection, prohibited the movement of cattle from Southern Rhodesia to the Congo. As a consequence, the prices for stock have been high. This embargo was removed a few years ago.[49]

Nyasaland

Nyasaland is a British Protectorate lying between Northern Rhodesia and Lake Nyasa and extending southward into Portuguese East Africa in the Shire River valley. The country is mountainous in character as a rule

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[47] Oxford Survey of the British Empire, Vol. III, *Africa*, pp. 201-231.

[48] Ainsworth-Davis, *Meat, Fish and Dairy Produce*, Resources of the Empire Series, Vol. I, Part II, p. 44.

[49] "Memorandum on the Cattle Industry of Southern Rhodesia," *Rhodesia Agricultural Journal*, 1921, p. 294.

and the uplands are fairly temperate in climate, but the lowlands are torrid. It is described as essentially an agricultural country,[50] but the development has been mainly in the form of "booms" for various crops and attention has in consequence been diverted from the livestock industry. Ticks and tsetse flies are also serious obstacles to the progress of animal breeding. In 1920 there were estimated to be 84,000 cattle, 38,700 sheep, 143,540 goats and 18,850 pigs, most of which were owned by natives. The cattle are of the Afrikander type and the humped species and the sheep belong to the native fat-tail breed. However, British cattle breeds have been brought in to cross with the humped cattle and the sheep have been improved somewhat by the introduction of Merino blood.[51] The highlands west of Lake Nyassa and the Shire River are the best region for cattle and the only place where pigs are plentiful. Cattle also are said to thrive well along the lake and the river.[52]

Tanganyika Territory

The former German East Africa, now under British mandate and known as Tanganyika Territory, is a country of about 365,000 square miles lying within the tropics on the east coast of Africa above Portuguese East Africa. The coastal region is low and unhealthful. The interior, however, is covered with hills and plateaus supporting thick forests, but also affording pastoral and arable land. These districts are described as potentially good for live stock.[53] In 1921, official estimates showed 3,147,000 cattle

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[50] Oxford Survey of the British Empire, Vol. III, *Africa*, pp. 231-250.

[51] Ainsworth-Davis, *Meat, Fish and Dairy Produce*, Resources of the Empire Series, Vol. I, Part II, p. 48.

[52] Oxford Survey, *loc. cit.*

[53] *U. S. Commerce Reports*, May 7, 1923, p. 406.

and 3,405,000 sheep.[54] Comparisons with the statistics for neighboring countries show that the live-stock industry is well advanced here. The government authorities have been very forward in assisting the pastoralists to combat animal diseases. In 1921, 8,775 head of live stock were exported.[55]

Kenya Colony and Protectorate

This country was formerly known as British East Africa and lies north of the old German territory. In spite of its equatorial position, all accounts rate it as a much better live-stock country than its southern neighbor, although it is less heavily stocked at present.[56] The area amounts to about 212,000 square miles.

The climate is very greatly influenced by the high altitude of the country, a great deal of the surface lying between 5,000 and 8,000 feet above sea level. In these altitudes the climate is sufficiently moderated to be suited to raising meat animals.[57] In fact, it is claimed that pure-bred British stock thrives there with proper care.[58] Rainfall and grazing conditions vary greatly between the different districts. The extreme north and much of a belt between the coastal region and the 5,000-foot level tend to be dry. Even here, however, desert conditions do not exist and the country, particularly in the north is given over to live stock. In other parts the rainfall is very great and vegetation excessive for a ready development of the industry. In many of the plateau regions, however, conditions for stock breeding are good. The climate is moderate, water supplies

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[54] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1036.

[55] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 47.

[56] A. W. Pearse, *The World's Meat Future,* pp. 266-277.

[57] Oxford Survey of the British Empire, Vol. III, *Africa,* pp. 261-280.

[58] Pearse, *loc. cit.*

ample and vegetation excellent. It is even reported that clover is abundant in places in addition to good native grasses. Some of the land, on the other hand, is too valuable for grazing and will be utilized increasingly for coffee and other tropical crops.

Lack of convenient means of communication and the widespread presence of ticks and tsetse flies have retarded the development of stock raising. A railway has now been constructed and systematic dipping is controlling the ticks. The government authorities are now taking serious steps toward the successful solution of the problem of disease.[59] There is every prospect of a large meat production in this country as it becomes more subdued to civilization and as the world demand for meat increases. The available statistics show a great increase within recent years in the number of cattle but a decrease in the number of sheep and goats. In 1925, estimates showed a live-stock population of 3,416,589 cattle and 2,678,796 sheep and 3,505,372 goats.[60]

Uganda Protectorate

Uganda lies just west of Kenya in the heart of Africa and covers an area of 110,300 square miles, including 16,169 square miles of water in the lakes and rivers of the source of the White Nile. The natural characteristics of the land are similar to those of Kenya. Even the same tendency toward aridity in the north exists and the remainder of the country has a greatly varying, but generally abundant rainfall. Dense forests are also interpersed with good grazing land. The tsetse fly has made great ravages here and sections have lost their human population.

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[59] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 46.

[60] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 223-231.

This pest is being controlled to a limited extent and the population is learning to avoid its disastrous effects.[61] The live-stock industry is fairly well developed in the hands of the natives and there has been talk of establishing regular slaughterhouses.[62] In 1925, estimates showed 1,341,597 cattle, 604,035 sheep and 1,180,839 goats.[63] These belonged to various native species.[64]

Anglo-Egyptian Sudan

The Anglo-Egyptian Sudan lies to the south of Egypt, being separated from the latter country by the Nubian Desert. It extends southward to the borders of the Belgian Congo and Uganda, having French Equatorial Africa on the west and Abyssinia, Eritrea and the Red Sea on the east. The Lybian and Nubian deserts cover the northern portion, but going southward there is an increasing amount of rainfall. In the extreme south in the regions of the equatorial monsoons there is a sufficient rainfall to maintain agriculture without irrigation, while the Gazira Plain between the White and Blue Niles has very large areas of soil that is extremely fertile when irrigated.[65]

There is no very certain knowledge as to the numbers of cattle in this extensive country, but, aside from the desert regions, the natives keep large numbers of cattle, sheep and goats of the primitive breeds. A surplus is already being produced for export.[66] Particularly during the war

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[61] Oxford Survey of the British Empire, Vol. III, *Africa,* pp. 281-298.

[62] *U. S. Commerce Reports,* May 7, 1923, p. 406.

[63] *International Yearbook of Agricultural Statistics, loc. cit.*

[64] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 46.

[65] Oxford Survey of the British Empire, Vol. III, *Africa,* pp. 318-377.

[66] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Vol. I, Part II, p. 36.

years, the exports to Egypt were large, as many as 26,000 cattle and 133,000 sheep and goats being exported in single years.[67] With modern methods and good stock employed in the industry this country could readily export a very material surplus.

British Somaliland

The Somaliland Protectorate lies on the north of "The Horn of Africa" beside the gulf of Aden. The surface of the land is high, rising from the coast in a series of terraces. The climate is hot and dry and what rainfall exists is highly seasonal. The inhabitants have absorbed many Arab customs and much Arab blood. Like their neighbors in Arabia, they are pastoralists. In fact, the main occupation in the country is the tending of nomadic flocks and herds. The sheep are almost woolless and the cattle are small and humpbacked. There are said to be about two or three million camels and perhaps four million sheep. Cattle are scarce excepting in a few localities.[68] Live animals for slaughter are exported to Aden, as many as 108,865 sheep and goats and 2,993 cattle having been exported in a single year.[69]

British West Africa

The British possessions and mandated territories in West Africa include Nigeria, Gambia, Sierra Leone, the Gold Coast Colony, Ashanti and the Northern Territories. With the last three of these is associated administratively the section of the former German Togoland now under British mandate. The largest of all is Nigeria, to which is

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[67] *Commerce international du bétail et de ses dérivés*, pp. 14, 17.

[68] Oxford Survey of the British Empire, Vol. III, *Africa*, pp. 299-317.

[69] *Commerce international du bétail et de ses dérivés*, pp. 14, 17.

attached administratively that part of the Cameroons now under British mandate.

Gambia is a small narrow country in the lower Gambia River Valley and is exposed to severe tropical conditions. The live-stock resources are undeveloped although large herds of cattle are kept by the natives and hides are exported.[70]

Sierra Leone, including the Protectorate, covers about 25,000 square miles between French Guinea and Liberia. The country is mountainous, but not sufficiently elevated to escape the rigors of the tropical climate. There is plenty of rainfall and the soil is fertile, but the numerous cattle are poor in quality and subject to disease.[71]

The Gold Coast Colony, Ashanti, the Northern Territories and the part of Togoland under British mandate form a block of land with an area of about 92,600 square miles fronting on the Gold Coast. The country is generally low, hot and unhealthful for both man and beast but there are higher regions which afford better living conditions. The northeast corner, particularly, is described as a "splendid open country, which gives rich crops and pasture, and is capable, probably, under suitable conditions of transport, of supplying the whole of the Gold Coast with cereals and fresh meat."[72] A non-humped type of cattle similar to English animals in appearance, excepting for their small size, is bred in the whole country. In normal times these animals and others belonging to a humped type from the French territory are brought into the market at Coomassie. The number of the local cattle is increasing, but ordinarily the supplies from the French territories are much more

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[70] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 37.

[71] *Ibid.,* p. 37. Oxford Survey of the British Empire, Vol. III, *Africa,* pp. 386-404.

[72] Oxford Survey of the British Empire, Vol. III, *Africa,* pp. 404-422.

numerous. Sheep are plentiful throughout the country, goats are abundant in some districts and pigs are raised to a limited extent. All these animals are found in the local markets.[73] The grazing lands are unfenced and are common property. During the rainy season there is an abundance of good pasture, but in the dry season there is very little feed available. The industry is in a very primitive condition.[74]

Nigeria covers the country in the neighborhood of the lower Niger and its chief tributary, the Benue, and extends toward the northeast as far as Lake Chad. Its area is about 335,700 square miles. A section of the German Cameroon country amounting to 31,000 square miles and extending all along the southeastern frontier from the sea to Lake Chad is associated with the country under mandate. The coastal region is low and subject to tropical conditions at their worst. In the interior, the country generally has a considerable elevation. The central portion of the country has a varied topography, with some extensive portions naturally fairly well adapted to stock raising were it not for the presence of the tsetse fly.[75] The northern section is a plateau fairly high in Haussaland and settling to lower levels toward the river in the west and Lake Chad in the east. This section is a fertile savannah with a moderate supply of water excepting toward the frontier where the plains stretch northward through the French Sudan to the Sahara. Toward the Lake much of the country is flooded during the rainy season. These plains are good pastoral country. Even as far north as Sokoto the

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[73] Ainsworth-Davis, *op. cit.*, p. 38.

[74] W. P. B. Beal, Report from the Colonial Office, London, on "Live Stock Breeding in the Northern Territories of the Gold Coast," in *Tropical Veterinary Bulletin*, Vol. IX, No. 1, pp. 36-50.

[75] F. R. Brandt, Chief Veterinary Officer for Nigeria, "Cattle Breeding in Nigeria," in *Cattle Breeding*, Proceedings of the Scottish Cattle Breeding Conference (1924), pp. 454-464.

rainfall is over 25 inches, but in the dry season the water problem is serious under present conditions.[76] The cattle of the north are of fair quality, but too much inbred, while those of the south are small and their chief virtue seems to be in their comparative immunity to the disease accompanying the tsetse flies. Woolless sheep and dwarf goats are also common.[77]

The cattle census of 1922-1923 showed 2,909,710 cattle, 1,823,326 sheep, 4,271,745 goats, 50,567 swine and 3,197 camels in Northern Nigeria. There is no record of the numbers of the dwarf cattle and goats of Southern Nigeria.[78]

The cattle are raised mainly by the seminomadic Fulani, who are but slowly settling down to regular agriculture. The Haussa farmers, on the other hand, who are attached permanently to the soil, do not concern themselves particularly with stock raising, although some small herds are found on their farms. The Fulani have several breeds of fairly good cattle most of which belong to the humped variety. All the cattle are slow in arriving at maturity and no care is taken to improve the breeds. However, it is considered that one or two of the breeds possess the possibility of being developed to as high a pitch of usefulness as the European breeds. This is fortunate, for disease is so widespread that there will be great difficulty in establishing imported breeds. Fencing is not practiced and the cattle are run in the open under the care of herders. The changes in grazing conditions throughout the seasons of the year cause the migration of the herds for considerable distances under present conditions, for the natives do not store fodder for the dry season nor do they provide wells

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[76] Oxford Survey of the British Empire, Vol. III, *Africa*, pp. 423-461.

[77] Ainsworth-Davis, *op. cit.*, p. 39.

[78] Brandt, *loc. cit.*

as a rule. Treks of about 200 miles are customary. This custom of migration takes the herds into the fly districts during certain seasons and is a very serious factor in the spread of many diseases.

Very severe epidemics of rinderpest, pleuro-pneumonia and other diseases have played havoc with the industry, and the numbers of cattle have decreased seriously within recent years. Veterinary control is being introduced slowly, but can hardly make great progress under the backward native conditions. It is interesting to note, however, that the natives have for generations practiced inoculation for pleuro-pneumonia in a crude manner. There is a gradual tendency now toward greater settlement, and, with the passage of the herding in the open, diseases can be better controlled and the breeds improved. The country has ample natural possibilities for a considerable development of the live-stock industry.[79]

Egypt

Only a small portion of the total area of Egypt is capable of being used for agriculture and animal husbandry on account of the lack of water. This is the Nile Valley and the Delta which cover only 12,226 square miles. In this territory most of the land is cultivated carefully, but in accordance with antiquated methods. Most of the farmers keep a few live stock, but the quality of the animals has been very little improved as yet. In 1925, the country had 722,943 buffaloes, 676,994 cattle, 455,059 goats and 1,091,016 sheep.[80] In 1921, 15,584 pigs and 756,000 sheep were slaughtered in the public slaughterhouses.[81]

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[79] *Ibid.*

[80] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 223-236.

[81] *Foreign Crops and Markets,* May 2, 1923, p. 305, and July 25, 1923, p. 89.

Egypt imports considerable numbers of animals from the Sudan. During the war considerable quantities of meat were imported from the Union of South Africa.[82] Recently the imports have been smaller.

Abyssinia

Abyssinia, or Ethiopia, is an independent country in east equatorial Africa. It lies at the northern extremity of the great highland region of this continent and the climate in consequence is not, as a rule, extremely hot. Some sections, particularly in the extreme east, are dry, but the country as a whole is well-watered and possesses excellent agricultural and pastoral possibilities. Farming methods, however, as in all native Africa, are exceedingly primitive, the fertility of the soil is not well maintained and the live stock have to depend almost solely on unimproved natural pasture and a certain amount of hay. The pasture lands exceed the cultivated lands in area. Some of these lands are dry and the grass poor. The really fertile grazing lands are all on the table-lands or mountain sides. No artificial pastures exist, although it is said that alfalfa could readily be grown as well as root crops. The cattle belong to the humped species which are found in two classes, the desert animals, with well developed bony frames, and smaller and better built animals on the good pastures of the table-lands. There also are two types of sheep, a larger on the plains and a smaller on the mountains. Goats are bred in great numbers. Pigs are not raised to any extent, for the religious ideas of the natives preclude the eating of pork.

The stock of Ethiopian cattle is estimated to number 10,000,000 head and 1,500,000 are slaughtered for meat each year. The carcasses, however, are very light, the

[82] *Commerce international du bétail et de ses dérivés,* p. 85.

average ox only giving a net weight in meat of 264 pounds. Transportation difficulties and the poor quality of the animals stand in the way of any important export of either meat or animals. With modern methods employed in the whole industry Abyssinia could readily supply a considerable surplus of meat for the international market.[83]

Belgian Congo

The Belgian Congo is a very large tract of land in the center of Equatorial Africa. The whole country is drained by the Congo River and its tributaries and has a considerable elevation which increases materially westward toward the center of the continent.

The central and western parts of the country are largely covered with tropical forests. The higher regions, especially in the northeast, are covered with natural grass in many places and afford excellent pasture land for cattle. Only in the uplands are cattle kept by the natives. The cattle in the Congo show signs of the Zebu race. At present there are three distinct breeds, all apparently originating in some part of Africa. The average weight of these animals is about 660 pounds. The cattle reared according to the native method mature late and do not finish their growth until 6 or 7 years old. Earlier maturity could be secured by better care. As ordinarily reared by the native, the cattle lead almost a wild life. In the wet season they live on pasture on the higher lands and in the dry weather have to be driven into the disease-laden valleys for feed.[84] Goats and sheep are native to the country and Sudan breeds are also established. The number of sheep and

[83] M. Boucoiran, *L'Afrique Française,* Renseignements Coloniaux et Documents publiés par le Comité de l'Afrique Française et le Comité du Maroc (1918), No. 11, pp. 177-210.

[84] F. Marcq, "Un voyage d'études zootechniques au Congo oriental," *Annales de Gembloux,* Vol. XXX, No. 1 (Brussels, 1924), pp. 1-40.

goats amounts to about 1,000,000 head. The breeding of these animals is not combined with cattle raising but is carried on by the small landholders. The meat of these animals is eaten and in some districts they are used as a medium of exchange. Pigs are kept only by the Europeans and a few chiefs. The ability of the native tribes to raise animals successfully varies greatly. With some tribes stock is of great importance. Animals are used as money and chiefs sometimes possess as many as 5,000 animals.[85]

Diseases, of course, are common, as must be expected in a new tropical country. The Belgian Congo seems to be the center and origin of the tsetse fly and its accompanying diseases. The breeds of animals which are established are fairly well immunized to disease but even the wild animals succumb at times to epidemics.

The future of the live-stock industry in the Congo is a matter of speculation. It is almost certain to be developed in the districts better fitted by nature for the breeding of domestic animals. At present the industry is almost wholly in the hands of the natives and a large part of the country now inhabited by Europeans is "fly" area. No striking progress can be anticipated unless the white man is able to take a leading part in the future developments. What part he will finally play in the agriculture of the country remains to be seen. The official accounts of progress may be described as at least encouraging,[86] but at present the country is distinctly on the meat-import basis. The chief economic developments so far are mining and similar industrial pursuits and, since the opening up of the country has progressed rapidly in the last few years, there is a growing demand for outside supplies of meat.

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[85] Willaert, "L'Élevage et les races d'animaux domestiques dans l'Uele" (Congo Belge), *Bulletin agricole du Congo Belge,* March, 1922, pp. 3-43.

[86] E. Leplace, *Un voyage agricole au Congo Belge,* Ministère des Colonies de Belgique Direction de l'Agriculture (Londres, 1918).

This increased demand comes not only from the expanding white population; the native mine laborer is also a great consumer of meat. The chief source of supply is from the British colonies to the south with which rail connection exists. Northern Rhodesia takes the leading place in this trade, which amounts to about the equivalent of 4,000,000 pounds of beef a year. The beef is imported on the hoof in the form of the small cattle of indifferent quality raised in Northern Rhodesia. Very recently the better supplies of Southern Rhodesia have been made available to the Congo market.[87]

Angola

Angola, or Portuguese West Africa, lies on the west of Africa below the Congo River Basin and north of the former German possessions in southwest Africa. The area is about half a million square miles and the country lies wholly within the tropics. The coastal strip is very hot and barren, but the interior is hill land and has an ample rainfall. Cattle are bred there on free range. These cattle belong to native breeds with or without humps. They are small and give a meat yield of not more than 47 per cent with a carcass weight of less than 400 pounds. They are slaughtered for consumption in the towns and both live animals and preserved meat are exported. Sheep are rare, but there are many pigs. These belong mostly to the native breeds, although English breeds are being introduced. Goat raising is but little developed. The tsetse fly is present, but does not seem to be very prevalent.[88]

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[87] "Memorandum on the Cattle Industry" (Rhodesia), *Rhodesia Agricultural Journal*, 1921, pp. 293-296.

[88] "Stock Breeding Conditions in the Districts of Benguela and Huila, Angola," in *Revista de medicina veterinaria*, Vol. XII, Nos. 155, 156, pp. 321-324, 359-365; Vol. XIV, Nos. 157 to 159, pp. 1-9, 45-50, 79-86 (reviewed in *International Review of the Science and Practice of Agriculture*, Vol. V (1915), pp. 1365-1367), and Marcq, *op. cit.*

Portuguese East Africa

Between the Indian Ocean and the range of mountains on the east of Southern Rhodesia and extending somewhat around the northeast corner of that country is Portuguese East Africa. This country has an area of 428,132 square miles. Near the ocean the country is flat, swampy and unhealthful. Toward the west it increases in elevation and the higher plateaus present good living conditions. In spite of the fact that the interior is well wooded, agriculture and animal industry are being developed. The raising of cattle for beef is growing into quite an industry, large tracts being taken up for grazing. Experience has proved that scientific breeding and care of the animals meet with success. The country is being opened up with railways and other means of transport. Other industries are being developed faster than stock raising, however, and imports are necessary to meet the demands of local consumption. Cattle for slaughtering are shipped in from Swaziland, the Transvaal and Southern Rhodesia.[89] It is estimated in the latter country that the import requirements of Portuguese East Africa for draught oxen and butcher animals amount to 2,000 head a year.[90] The number of cattle and pigs in the country is increasing rapidly, however, although the number of sheep and goats is declining. The latest estimates show 357,630 cattle in the entire country and 27,912 sheep, 13,271 goats and 17,271 pigs in the district controlled by the company.[91]

Eritrea

Eritrea is an Italian possession north of Abyssinia on the Red Sea. The lowlands along the sea have a tropical

[89] *U. S. Commerce Reports*, April-June, 1919, p. 1039.

[90] "Memorandum on the Cattle Industry," *Rhodesia Agricultural Journal*, 1921, p. 293.

[91] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 223-235.

climate while the uplands are cool. The rainfall is sufficient for agriculture and pasture is abundant, but the pastoral population is partly nomadic. Every native is said to be in possession of a certain number of cattle, sheep and pigs. In 1922, there were 553,311 cattle, and 1,701,496 sheep and goats. The trade in live stock and its products is very limited and the animals belong to unimproved breeds. On account of excessive heat, pests and general lack of scientific care, the better breeds of all meat animals, but pigs, have degenerated.[92]

Italian Somaliland

Italian Somaliland, like the British Protectorate, is dry and mostly occupied in pastoral pursuits. The live stock are fairly numerous although fewer per unit of total area than in the latter country. A census taken in 1921 by counting the animals at the watering places showed 2,101,678 camels, 1,246,461 cattle and 1,566,308 sheep.[93]

Tripolitania and Cyrenaica

These Italian dependencies lie on the northern coast of Africa west of Egypt and extend southwards into the desert. The climate is very dry, except in a few favored regions, and in general the countries are barren. However, stock raising is practiced extensively. No statistics are available as to the numbers of the animals, but Tripoli is estimated to have at least a million and a half sheep.

The countries are best suited to sheep and goats, which before the war were raised in sufficient quantity to maintain an important export trade. One hundred thousand

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[92] G. B. Tarastino, "L'Eritrea ed il suo bestiame," *Allevament*, Vol. II, No. 12, pp. 401-403; Vol. III, No. 1, pp. 17-19; Vol. II, No. 10, pp. 306-309.

[93] Ministero delle Colonie, Ufficio Affari Economici, *Bollettino di informagioni*, Vol. IX, Nos. 4-5, pp. 278-280.

head of sheep a year were shipped to Egypt, Malta and Italy from Tripoli.[94] The sheep belong to the Syrian breed which have fat tails and are covered with wool. They are usually in good condition and not infrequently give a dressed weight of over 80 pounds when slaughtered.[95]

Liberia

This republic, organized by freed slaves from America, has a territory of about 40,000 square miles on the west coast of Africa. Very little development has been made in agriculture or animal husbandry.

French Equatorial Africa

French Equatorial Africa (formerly called the French Congo), with the part of the Cameroons now under French mandate, is a fairly wide belt of country between the British Nigerian and Cameroon district and the Belgian Congo. It extends northward from the latter country to the Sahara and meets the Anglo-Egyptian Sudan on the east. The resources of Gobun, which is near the coast, and the central district are undeveloped. This country is largely in tropical forest. The hinterland of the Cameroon country has some successful cattle raising.

The northern section known as the Chad Colony is an important cattle country. It is estimated that there are about 1,000,000 head of adult cattle in this district. Disease is common and the care of the cattle is primitive.

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[94] A. Caselli, "Tripoli Wools and Means of Improving Them," *Bollettino dell'industria laniero*, Aug. 31, 1919, pp. 158-161 (reviewed in *International Review of the Science and Practice of Agriculture*, Vol. XII, No. 1 (1921), pp. 130-131).

[95] Q. Franchi, "Veterinario coloniale presso il governo della Cirenaica," *Il Nuovo Ercolani*, Vol. XXIV, Nos. 15-19 (reviewed in *International Review of the Science and Practice of Agriculture*, Vol. XII (1921), pp. 1303-1306).

Nevertheless, the animals tend to be fat and a surplus is shipped out, chiefly to Nigeria. Weekly markets are held for the assembling of the cattle. The natives eat goat's flesh and mutton, but no beef.[96]

French West Africa

French West Africa consists of a number of districts south and west of the Sahara, several of which reach out to the sea. Mauretania, Senegal, French Guinea, the Ivory Coast and Dahomey lie on the Atlantic. The French Sudan, the Upper Volta and Niger are inland districts on the borders of the desert. Beside Dahomey is the portion of former German Togoland now under French mandate.

It may be said that this territory in general is hot in all parts, but that the heat is moderated somewhat and the rainfall grows less as the elevation increases, going from the coast toward the interior. As the Sahara Desert is approached the elevation becomes less and the rainfall disappears. In the north semi-arid conditions approach the sea. Live stock is maintained with varying degrees of success all over the territory. Near the coast the tendency to disease is generally so strong that no animals survive but those whose chief virtue is their power to resist complete destruction. Tropical forests also tend to stand in the way of any great development of the live stock. Farther inland the natural handicaps are less. Between the desert and the sea is an intermediate zone which can be classed as savannah where the grazing is excellent at least part of the year and where with the provision of wells and artificial feed for the dry season the live-stock industry can be made successful. Unfortunately, the fly-borne disease of the coast is not much worse than the epidemics of rinderpest

[96] G. Pecaud, "Les boeufs du lac Tchad," *Revue d'histoire naturelle appliquée,* Part I, Vol. V, No. 4, pp. 97-107; No. 5, pp. 141-146.

and pleuro-pneumonia which devastate the animals on the plains. As in all other arid lands, sheep and goats tend to take the first place as the country becomes drier.[97]

The following table gives the best available statistics of the animals in the various districts.[98]

LIVE STOCK OF FRENCH WEST AFRICA

Territory	Cattle	Sheep	Goats
Senegal	800,000	250,000	700,000
French Sudan and Upper Volta ..	1,800,000	2,500,000	3,000,000
Mauretania	500,000	2,000,000	3,000,000
Guinea	400,000	800,000	1,000,000
Dahomey	.....	150,000	200,000
Ivory Coast	.....	400,000	200,000

The natives in all these regions are very loath to reveal the full numbers of their stock, and it is roughly estimated that with those in the other territories the full number of cattle cannot be less than 5,000,000 in all French West Africa.[99] The numbers of the stock have been reduced very seriously by disease in the last few years. The exact extent of the losses is not known, but is estimated as not less than 2,000,000 cattle. Rinderpest broke out in the Niger regions in 1915 and spread by the caravan routes all over the country. The mortality was particularly great among the young stock, and with the adults varied from 10 to 60 per cent according to the breed and region. The humpless cattle suffered most while the Zebu type was more resistant. Sanitary measures and serum were used to combat the epidemic.[100]

[97] "Stock Rearing in French West Africa," *International Review of the Science and Practice of Agriculture*, Vol. II, p. 615.

[98] *Revue general du froid et des industries frigorifiques*, Vol. II, No. 4, p. 137.

[99] *Ibid.*

[100] "Stock Rearing in French West Africa," *loc. cit.*

The cattle belong to unimproved breeds. Nevertheless, they are fairly good meat producers. Their live weight is said to be about 660 pounds and their carcass yield 49.5 per cent. If disease can be controlled and better methods introduced in caring for the herds, these countries might well become a real source of surplus supplies of meat. French Guinea has deep valleys intersecting the plateaus which yield pasture during the dry season and this region exports to other portions of the territories and to Portuguese Guinea. This country is even equipped with a cold storage house for the beef trade, but most of the exports go on the hoof.[101]

The sheep belong to indifferent breeds. Many parts should make excellent Merino country, but, although many of the sheep have wool, they do not belong to a good wool-producing type. Unfortunately they are also poor mutton producers. With proper organization of the industry many parts of the upper Niger basin could be developed into an excellent sheep country.[102] The French have already done much to improve the country and it may be anticipated that, in the course of time, these territories will prove a source of considerable quantities of meat of fair quality.

Morocco

Morocco covers approximately 231,500 square miles in northwestern Africa most of which is under French jurisdiction, Spain claiming a small area. An important part of the native population has recently been disputing the sway of both nations.

The country is generally mountainous, being traversed by several chains of the Atlas range. The western section

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[101] *Ibid.*, No. 6, p. 206.

[102] H. Yves, "La laine du Soudan," *L'Agronomie coloniale, bulletin mensuel du jardin colonial,* Vol. III (1918-19), No. 22, pp. 97-108.

enjoys a temperate climate with an ample rainfall and only the interior next the desert is seriously arid.

The native cattle are small and poor milkers but are hardy and are very little affected by the scantiness of the feed they obtain in the dry season. Zebu bulls and stock from France have been imported to improve the cattle, but very little gain has so far been achieved. There are three distinct types of sheep. The Tadla sheep are large, fatten quickly and make good butcher animals. The Beni-Ahsen breed is fairly large, but a poor meat producer. The Berber sheep are more widely kept and are small. Better breeding stock has been imported for some time, with but indifferent results. The goats serve fairly satisfactorily as meat producers for the native population. Pigs are raised mostly by the European settlers and the Yorkshire breed is being introduced to improve or replace the native stock.

The number of cattle in the country is estimated to be about 1,800,000; of sheep, 7,000,000; and of goats 2,000,000. There is an important export trade, mainly to France. In 1922, about 60,000 head of cattle, 35,000 sheep and 60,000 pigs were exported. In addition there was a large transfer of sheep over the Algerian border.[103]

Competent experts claim that the live-stock production of the country can be increased very greatly when the prevailing antiquated customs are replaced by modern methods of animal husbandry.[104]

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[103] Communication from the Stock Breeding Service of the Department of Agriculture in the *International Review of the Science and Practice of Agriculture*, January-March, 1924, pp. 34-39; Schoeffler, "Le Mouton 'Beni-Ahsen,'" *Révue de zootechnie*, Vol. II, No. 8, pp. 113-120; *Foreign Crops and Markets*, U. S. Department of Agriculture, June 25, 1924, 572.

[104] Pearse, *The World's Meat Future*, pp. 263-265.

Algeria

The French Colony of Algeria covers 222,180 square miles on the north of Africa. It is an important source of meat for the French market.

In the neighborhood of the Mediterranean there is a small area of highly fertile plains and valleys which is cultivated scientifically, but much of the rest of the country is not well supplied with water and modern methods of agriculture and animal husbandry are not yet sufficiently well introduced to overcome the natural difficulties and make the most out of the possibilities of the country. The north is generally mountainous. The middle is a region of steppes or table-lands. Farther south the Sahara region is entered and, excepting near the oases, or in certain regions for limited periods after rains, the country is barren. Some success has been met with in supplying water to this region from wells. In these semi-arid regions, pastoral life is the leading industry and in the forests of the middle region it is important.

The numbers of the live stock in 1920 were estimated as follows: cattle, 1,125,000; pigs, 125,000; sheep, 9,000,000; goats, 3,750,000.[105] Cattle are kept largely for draught purposes and are exported to France for beef. Hogs are also exported, for the local population is largely Mohammedan or Jewish and does not eat pork. The meat consumed locally is chiefly goats' flesh and mutton. Nevertheless, there is a large export trade in sheep to the French markets.[106] On the other hand, canned meat is imported.[107] With the development of the country under

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[105] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1031.

[106] *Supplement to U. S. Commerce Reports,* "Algeria," 1922, pp. 22, 23.

[107] *U. S. Commerce Reports,* Jan. 7, 1924, p. 46.

French direction it may be anticipated that great improvements will be made in the industry and the meat production considerably increased.

Tunis

Tunis lies to the east of Algeria between the Mediterranean and the Sahara. The northern part is mountainous and intersected by fertile valleys. The northeast is a fruit district. The center is a region of high table-lands and pastures and the south, with its oases, disappears into the desert. The chief industry is agriculture and large estates predominate. The live-stock industry is important and there are 11,462,500 acres of stock land as opposed to tillage land. In 1921, the country had 488,000 cattle, 2,038,000 sheep, 1,114,000 goats and 18,000 swine. Live stock are exported. The oxen are excellent work animals and fatten fairly well, although they give a meat yield of only 47 to 50 per cent. Zebus of various origins have been introduced to improve the quality of the cattle. The native sheep belong to the Barbary breed and give good mutton with a carcass yield of 40 to 47 per cent. The pigs belong to the Iberian breed. The government is taking measures to increase the efficiency to the live-stock industry.[108]

Madagascar

The island of Madagascar situated about 240 miles off the southeast coast of Africa belongs to France. It is one of the largest islands in the world, covering an area of about 225,000 square miles. Except in the southwest, where the country is too dry, and on the east coast, where it is too wet, the rainfall is moderate. Natural pastures are abundant and usually productive. The highland char-

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[108] "Le Cheptel Tunisien," *Annales de l'Institut Colonial de Bordeaux*, March, 1924, pp. 81-82.

acter of the country and its situation on the edge of the tropics gives it natural advantages for live stock.

Madagascar is one of the most important of the French possessions in relation to the live-stock industry. Recently, official estimates indicated a live-stock population including 7,366,516 cattle, 313,999 swine, 110,114 sheep and 57,227 goats.[109] Owing to the tendency of the natives to underestimate their herds to the officials it is considered that there may easily be as many as ten or twelve million head of cattle in the island. There has been a very marked and steady increase in the herds during the past two decades as a whole, but other animals than cattle have decreased in these last few years.

Animal diseases are less common in Madagascar than in most parts of Africa. The island isolation saves the stock from the epidemics which have been so serious on the mainland. Yet tuberculosis is very bad among the cattle, and anthrax is also common. The government is taking serious steps to combat the latter.

The native cattle belong to the Zebu race, although there are a few humpless cattle near the town, based partially on imported stock which are kept for their better milk-producing qualities. The qualities of the Zebus vary from one locality to another. Some when well fattened weigh as much as 1,200 to 1,600 pounds; others are much lighter and poorer in quality. During recent years the government has taken the initiative in introducing European breeding stock to improve the herds.

There are a few cattle ranches on the island in the hands of Europeans, but most of the cattle are raised by the natives in accordance with their rather primitive customs. Cattle are the mark of wealth with the native. The cattle, as a rule, live in the pastures throughout the

[109] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 223-235.

whole year and live solely on what nature supplies whether it is dry or wet. Breeding is indiscriminate and there is a large calf mortality due to neglect. Maturity and full size come only at the age of six to eight years with these animals. Nevertheless, the natives do take the care to fatten some of the cattle. Some of them are fattened on the choice grass in isolated mountain valleys and some are fattened in crude stables on artificial feed. Some of these fat cattle give a net slaughtering weight of as much as 65 per cent and the quality of the meat is very good. At one time it was estimated that as many as 40,000 cattle were stall fattened annually in the chief fattening district, but this phase of the industry has recently lost its importance. The chief of the Veterinary Service estimates that, apart from local consumption, the herds of the island can furnish annually for export about 250,000 grass-fed cattle, of which at least 100,000 would be fattened on pasture, and an additional number of several thousand stall-fed cattle.

There are six factories in the island for the preparation of cured and refrigerated meat. Two of these are prepared to cater to the frozen-meat trade. In the year 1916, one of these latter alone put out nearly 17 million pounds of frozen beef. Exports of beef are chiefly in the canned and frozen forms. Cattle are also exported alive in considerable numbers. Before the Union of South Africa restored its stock after the epidemics of cattle disease and the devastation of war, large numbers were shipped to that country. The island of Mauritius is now the chief customer and Reunion also takes a number. The former took 16,509 head in 1921 and the later took 1,437.

Local consumption is also important. The natives consume large quantities of meat. The urban consumption is quite regular, but in the country, beef is used only on special occasions. It is estimated that about 250,000 head of cattle are required each year for home use.

The sheep belong to the woolless, fat-tail race and their meat is very mediocre. Their numbers are tending to decrease and efforts to improve the breed or to establish European wool breeds have not met with great success. The native goats are also of poor quality and are tending to decrease in numbers. Efforts to introduce Angoras from South Africa, however, appear to be successful. The hogs belong to native races and the government is attempting to improve the breeds or to introduce entirely new types. This work is still in the experimental stage and, in spite of the efforts, the hog industry appears to be declining.[110]

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[110] A. T. Burri, *U. S. Consular Report,* April, 1923, "Stock Raising and Utilization in Madagascar."

CHAPTER X

OCEANIA

OCEANIA contains the continent of Australia with its neighboring islands, the two islands of New Zealand with their outlying neighbors and a number of scattering islands in the Southern Seas. Australia and New Zealand alone possess any particular importance in the live-stock industry. These countries, however, are but recently settled and take leading places among the world's meat-exporting nations.

AUSTRALIA

Australia is one of the world's leading meat-producing countries. However, in spite of the great size of the country, its exports of mutton and lamb are surpassed by those of both New Zealand and Argentina and its beef exports by those of the latter country. In beef production, Brazil and Uruguay are also tending to overshadow Australia, although the fluctuations in the recent annual figures leave the comparative status of these countries somewhat in doubt.[1] In pork production, Australia is not in the forefront. In the matter of dairy products, however, she is a leading competitor in international trade and her wool export is easily greater than that of any other country.[2]

NATURAL CONDITIONS

A continent in size and but newly settled, Australia might be expected to lead all other nations as a meat

[1] See pp. 576-583, *infra.*

[2] *Commerce international du bétail et de ses dérivés,* pp. 69, 70.

producer. Her area, including the island of Tasmania, is nearly three million square miles and about one thousand square miles larger than continental United States. There is room for vast flocks and herds. Nature, however, has been bountiful to Australia only in limited measure. Nearly 40 per cent of the country is within the tropics and more than two-thirds of the area has less than twenty inches of rainfall in a normal year.[3] A material portion of the center of the continent is real desert and on a substantial part of the remainder brooks and rivers that succeed in getting started find themselves lost in the sands or flowing into Lake Eyre, which, like the Dead Sea, has no outlet, evaporation keeping its level distinctly below that of the ocean. A mountainous border along the entire east coast of the continent removes the major portion of the water from the prevailing winds of the Pacific. As a consequence, only the eastern section of the interior gets rainfall enough to maintain streams throughout the year and even the coast on the south and west gets but a small amount of water. In the north, in the most tropical regions, the land near the coast is subject to the monsoons. Frequently the summer wet season is followed by months of drouth. A peculiar feature of the eastern portion of the interior is that much of the rain that does fall is absorbed into a subterranean reservoir of porous sandstone which gives up its water again through artesian wells that have been bored in considerable numbers. This artesian basin includes about 570,000 square miles of territory. Unfortunately, the water from these wells frequently contains salt and other minerals and comes from such a depth that it is hot. However, it is not unfit for

[3] H. E. Gregory, "Lonely Australia the Unique Continent," *National Geographic Magazine*, December, 1916.

the use of the live stock, although it is not well suited to irrigation.[4]

The better parts of Australia, in spite of the lack of abundant rainfall, were originally covered with timber rather than grass-grown prairies, for the eucalyptus trees, which in their various varieties are the predominant trees, have adapted themselves to all possible conditions, spread thinly with extensive roots in the semi-arid sections and degenerating to bushes on the borders of the deserts. These trees were destroyed over extensive areas by the pioneers who killed them by cutting off a ring of bark. The trees were left standing as bare skeletons, but the absence of foliage allowed the sun to reach the surface of the ground and abundant grass developed for the flocks of sheep. This was the original manner of pioneer development. Viewed in the light of the standards of more settled countries, this destruction of the forests was wasteful. However, it seemed the only practicable way of opening up the land to civilized use, and at the time, there was no market that would use the timber. This rough-and-ready extensive method of utilization was necessary as an initial stage in land development and, while it is not looked upon with popular favor to-day, it paved the way for later more thorough and less wasteful forms of cultivation.[5]

Aridity of large portions of the continent is not Australia's sole problem of drouth. Periodically even the wet sections suffer from lack of water. During the year 1924 the northern part of Queensland, which is normally the wettest part of the country, was so dry that many cattle died from starvation and lack of water.[6] Drouths are frequent. The years 1902, 1908, 1912, 1914-15, 1918-20 and 1922-23 stand out as the worst in recent history. In

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[4] Oxford Survey of the British Empire, Vol. V., *Australasia,* p. 9.
[5] *Ibid.,* pp. 124-129, 177-209.
[6] *Queensland Agricultural Journal,* February, 1925, p. 127.

the latter years the interior of the continent is said to have experienced one of the driest periods on record.[7] During these drouths the number of the live stock in the country frequently declines quite materially, many animals perishing for lack of food and water and as many as possible being slaughtered. Between these years of drouth the country recovers remarkably. The grass sprouts up almost immediately when the rains come and the optimism of the people seems almost as quick to recover.[8] Between these drouths, periods of excessive rainfall have occurred which were very destructive over wide areas.[9]

Australia has also allowed herself to fall a victim to pests of other than native origin. Rabbits and foxes were introduced by the British settlers to serve, in the lack of abundant native game animals, as a basis for the sport of hunting. Unfortunately, these animals proved unexpectedly prolific and have been very destructive. The rabbits grew so numerous that they injured the grass on wide areas. Great expense has been taken to eradicate these animals, but they still persist. Unfortunately, rabbits, like grass, recover quickly when the rains come, and the periodic drouths have failed to stop the pest. As a last resort fences have been built to stop their progress from one part of the country to another. Many thousands of miles of these rabbit-proof fences have been placed across the country, reaching from half a foot below the surface to two feet and a half or four and a half feet above the ground. They extend from the coast back-country into the desert. Nevertheless, the rabbits still injure the pasture very seriously and foxes annually take a large toll in

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[7] *Official Year Book of the Commonwealth of Australia,* 1924, p. 648.

[8] Gregory, *loc. cit.*

[9] Oxford Survey of the British Empire, Vol. V, *Australasia,* pp. 124-129.

sheep. The cactus has also been introduced and has proved itself a serious nuisance.[10]

Australia, in common with all countries within the warmer belts, finds many animal diseases to combat. These, of course, are more serious in the north under tropical conditions.

Thus Australia, although a fairly large continent, has had so many handicaps that the live-stock industry has not had an opportunity to expand as it would have under more favorable conditions. It also is hopeless to anticipate that this country will ever be so productive per unit of area as many other portions of the earth's surface. However, it must be remembered that no country has really ideal conditions and that Australia has no regions made barren by cold and but little mountainous territory so high or rugged as to be ultimately unproductive. The distance of Australia from the great markets of western Europe and the fact that her meat before reaching these consuming centers must spend weeks in transit through the tropical regions give this country a severe handicap in meat production. This is particularly true in the case of beef which, in spite of all efforts to make shipping of chilled beef commercially successful, must still be shipped in a frozen condition and, hence, finds but a secondary position on the British market. Serious efforts are being made to correct this difficulty, recent efforts giving promise of success. The extreme seasonality of production, making it difficult for the Australians to maintain highly developed marketing facilities in England throughout the year, also stands in the way of the more rapid advancement of the industry.[11]

Comparatively little of Australia was originally treeless prairie. In some regions the trees and bushes were very

[10] Gregory, *loc. cit.*
[11] *Report on the Trade in Refrigerated Beef*, etc., pp. 12-14.

scattered and in almost all sections there was sufficient grass among the taller vegetation to serve as the basis for a pasture growth when the trees and brush disappeared before ax and fire. The death of the trees after girdling with the ax allowed the sun to sweeten the soil and develop the grasses.

This native vegetation varying in kind and development between tropics and temperate zone, damp sea coast and semi-arid back-country, originally supplied the basis for all the true pasturage. In the drier regions shrubs and bushes supply valuable fodder, especially in dry seasons.[12] On the lands near the coast in the settled regions, which are well supplied with water, the native grasses are being supplanted by grasses introduced from other parts of the earth. Artificial pastures are laid down with seed from many different grasses, native as well as foreign. Ensilage is also made from corn and sorghums. In these areas the production of artificial pasture and cultivated fodder is unquestionably successful and the pastures are fenced. In the interior the possibility of introducing new grasses under present known methods depends largely upon climatic conditions. Where the extremes of temperature or drouths are not too severe some of the better imported grasses can be grown. In more severe conditions the native grasses are superior to most of the foreign varieties, although Sudan grass is successfully grown under trying circumstances. The native grasses are particularly suited to the resistance of drouth. Even when the vegetation is completely scorched by drouth the seeds of these grasses germinate with the first rains. The pastures have deteriorated in many cases. Rabbits have been responsible to a certain extent, but overgrazing has also been the cause of much deterioration. Since it is the seeds

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[12] Oxford Survey of the British Empire, *loc. cit.*

that must be depended upon to restore the pasture after drouth, close grazing which does not permit the ripening of seeds is dangerous to the continuation of the pasture. Close grazing, leaving only the less desirable herbage to ripen seeds, has spoiled much good pasture. The attempt to introduce new grasses which flourish and choke out the native grasses during good weather has served to injure much good natural pasture when the inevitable drouths occurred. Weeds also have played havoc in some cases. Australia has a real grass problem. Alfalfa is being introduced successfully in some regions, but the level of water under the surface, even in the artesian basin where there is plenty of such water, is so very far below the surface that alfalfa does not find the ideal conditions encountered on the Argentine pampas.[13] This problem must eventually be solved, but Australia is still largely in the extensive stage of exploitation and her peculiar system of land tenure fails to give the desirable stimulus to the pastoralists to conserve the pastures as carefully as they might.

The land system of Australia is based upon the policy of securing "closer settlement" as rapidly as possible. Originally the pioneers secured ownership of the land on which they settled. This created some enormously large holdings. One holding of 60,000 square miles is recorded. There has been a strong reaction in public sentiment against such practices and the present land policy of all the states tends toward leasing, rather than selling, the land. Lands never alienated from public ownership and lands purchased from old squatters are now leased by the government on long-time contract or assigned to pastoralists under license. In 1922, 949,884,653 acres were held

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[13] E. Breakwell, "Native Grasses and Fodder Plants of Australia," Australia Advisory Council of Science and Industry, Bulletin No. 7, *Agricultural Research in Australia* (1918), pp. 115-124.

under lease or licence, 111,548,395 acres were definitely alienated from public ownership, 57,568,439 acres were in process of alienation and 784,730,353 acres were still occupied by the Crown or unoccupied in the whole Commonwealth.[14] There is some difference of opinion as to this system of land tenure. The majority of public sentiment certainly favors it, but the pastoralists object to it. Whether or not the comparatively slow progress made in developing the country is due to the lack of stimulus which comes from private ownership of land is too large a question for discussion here.

THE SHEEP INDUSTRY

Sheep were in introduced into New South Wales in the days of George III of England. A Captain Macarthur purchased from the King a flock of Merinos which was not flourishing in the damp English climate. Apparently other Merinos were brought from South Africa about the same time. The climate near Sydney was little, if any, better for these sheep, but the flocks were soon driven inland and they have flourished since on the dry inland plains. The Merino of the Australian plains is a different animal from its Spanish ancestors. The flockmasters have accomplished wonders in the improvement of this breed. The weight of the animals has doubled, that of the fleece has more than doubled and the quality has improved greatly since the breed was introduced to this part of the world. Moreover, different types have been developed even in Australia under the widely divergent climatic conditions, each type suiting its own peculiar environment. This breed improvement was accomplished under the squatter conditions of private land ownership.[15]

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[14] *Official Year Book*, 1924, p. 216.
[15] Oxford Survey of the British Empire, Vol. V, *Australasia*, p. 183.

The sheep of Australia, particularly in the back-country regions, are kept primarily for their wool rather than their flesh. The value of wool exported in the five years ending in 1923 was sixteen times that of the mutton and lamb exported.[16] In such commercial conditions it is no wonder that the predominant breed is the Merino. In the State of Queensland the Merino is almost the only breed used, only 3 per cent of the flocks belonging to the British breeds and their crosses.[17] In southeastern Australia more attention is paid to the raising of sheep and lambs for slaughter, and the bulk of the mutton and lamb exported comes from New South Wales and Victoria. There an increasing proportion of the flocks is composed of crosses between Merinos and the British breeds. However, even for the country as a whole, the pure Merino easily holds first place.[18] These sheep are raised on a very extensive scale. In 1919-20 there were twelve flocks recorded with 100,000 or more sheep to the flock. Flocks of 2 to 5 thousand sheep hold the largest place in the industry, but flocks of 20 to 50 thousand are also very important even in the southeastern states. The largest number of flocks, on the other hand, particularly in Victoria and New South Wales, are composed of less than 500 sheep.[19] While the great bulk of the sheep of Australia are on the big "stations," of late years, farmers have found it profitable to combine wheat growing with sheep raising. The result is an increase in the numbers of small flocks. The owners of small flocks have a pronounced tendency to build up the British breeds

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[16] *Official Year Book*, 1924, pp. 659, 666.

[17] *Queensland Agricultural Journal*, February, 1925, p. 119.

[18] F. R. Marshall, *Features of the Sheep Industries of the United States, New Zealand and Australia Compared*, U. S. Department of Agriculture, Bulletin No. 313, and *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries (London), 1924, p. 15.

[19] Production Bulletin No. 14, Commonwealth Bureau of Census and Statistics, p. 52.

and crossbred animals for the meat trade, while the large flocks are kept mainly for their wool. The small farms also carry more sheep per acre.[20] Since the tendency is toward the development of small holdings at the expense of the large ranches, it is apparent that in time the meat industry will increase in relative importance in sheep breeding.[21]

In the earlier days sheep were more profitable than cattle.[22] For some time, however, the numbers of sheep have tended downward, with violent fluctuations, while the cattle and pigs have been increasing. The chart on page 423 shows the relative trends in the numbers of all the live stock in the country.[23] In 1925, the Commonwealth had 13,054,125 cattle and 83,621,954 sheep. In 1923 there were 899,874 pigs.[24]

BEEF PRODUCTION

The cattle industry is carried on in all the states on a more or less extensive scale, but beef production is most important in Queensland. In the older and better-settled districts there is a marked tendency toward the development of dairying. In the north and west and the interior, beef production is the rule. The finest animals are those raised in the tropical regions of Queensland, the Northern Territory and the Kimberly districts in the north of Western Australia.[25] Nevertheless these animals are not the equals of those of the Argentine.

Queensland is fairly well supplied with marketing facili-

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[20] *Australia's Pastoral Industry,* Pamphlet of Commonwealth Immigration Office.

[21] Oxford Survey of the British Empire, Vol. V, *Australasia,* p. 180.

[22] *Australia's Pastoral Industry.*

[23] *Official Year Book,* 1924, p. 661.

[24] *International Yearbook of Agricultural Statistics,* 1924-25, pp. 200-213, and Weddell and Company, *Review of the Frozen Meat Trade,* 1925, p. 14.

[25] *Official Year Book,* 1920, p. 653.

ties and has brought her cattle industry up to a relatively high stage of development. The well-watered lands of

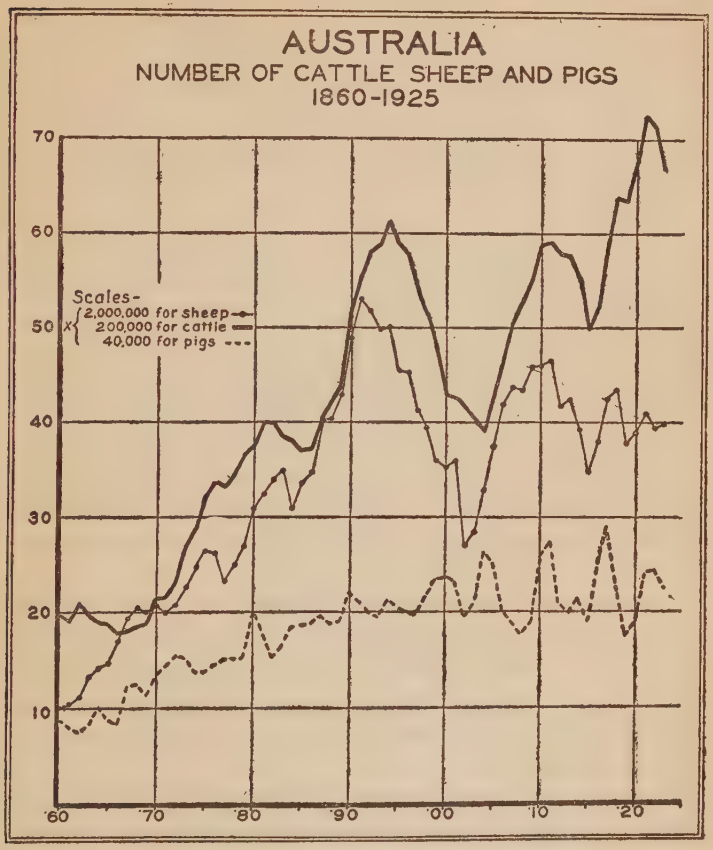

CHART 23.

the coast and the table-lands back of the mountains are being rapidly utilized. The most famous pastoral section of this state is the Darling Downs in the south, now mainly occupied by small holders, but the lands well into the

tropical north are being developed. Large areas of the plains are still to be developed and the mountain slopes have so far been largely neglected.[26]

The Northern Territory is distinctly tropical and has not as yet been developed to any great extent. Near the coast there is abundant water and development is sure to come in time as the market demands expand. The climate is held by good authorities to be fit for white men when proper precautions are taken.[27]

Western Australia covers a vast area, much of which is dry. The Kimberly districts in the extreme north hold the most cattle. This section is hot, but it has water, and cattle thrive in spite of disease. At present but little of the country is developed, only the land near the streams being utilized. The chief handicap has been a lack of marketing facilities. Its location nearer to England gives it a potential advantage, but the other sections which are easier to develop have been supplied with packing plants and railways, while this frontier country has had to wait. The settlers seem to feel that they must look to the government to supply all such facilities. There is a small development of the industry southward in Western Australia, but the product goes only to the local market which is limited in its demands.[28] South Australia, like the west, suffers from a lack of water excepting near the coast and on the hills and has even fewer cattle than the Northern Territory.

Victoria and Tasmania are fairly well settled and have plenty of water. Farming here has largely passed the extensive stage and most of the land is in small farms owned by the farmers. There is still some extensive graz-

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[26] *Australia's Pastoral Industry.*

[27] J. W. Gregory, "Tropical Colonization and the Future of Australia," *Nature,* Aug. 30, 1924.

[28] Pearse, *The World's Meat Future,* pp. 61-64.

ing, but on the whole, cattle and sheep are kept in relatively small, fenced pastures.

New South Wales is still the leading sheep state, but has a highly developed cattle industry. Dairying predominates near the coast, but in the back country there are vast runs where cattle are bred and fattened for market. Many of the large places are being subdivided and the fenced pastures are becoming more common. In this back country a distinct feeder industry has sprung up, the surplus animals from the dairy herds of the coast being sent back country to be fattened for the Sydney market.[29] Cattle raising has increased in importance in the state within late years, not only for dairying but also for meat production. Considerable quantities of beef are produced in the northern part of the state for internal consumption and export, and one of the meat plants ships chilled beef to the populous districts farther south.[30]

PORK PRODUCTION

The pig industry is not important as yet in the international market, but plays a considerable part in the the southwest. These animals accompany dairying and utilize the surplus skim milk. Coöperative and private bacon factories have been established and good pigs are being produced for their trade.[31] The record production of bacon and ham occurred in 1923 with 67,600,747 pounds. The average production for the postwar period, 1919-1923,

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[29] *Australia's Pastoral Industry.*

[30] *Official Year Book of New South Wales,* 1920, p. 420, and *Report on the Trade in Refrigerated Beef,* etc., p. 12.

[31] *Dairying in Australia,* Pamphlet issued by Commercial Immigration Office.

was 59,340,051 pounds, which showed a distinct increase above previous periods.[32]

INTERNAL TRADE

The following table shows the numbers of live stock in each of the states in 1922:

LIVE-STOCK POPULATION OF AUSTRALIA BY STATES, 1922[33]

State	Cattle	Sheep	Pigs
New South Wales..	3,244,905	34,723,684	340,579
Victoria	1,785,660	11,765,520	294,962
Queensland	6,955,463	17,641,071	160,617
South Australia	425,811	6,305,133	75,520
West Australia	939,596	6,664,135	67,561
Tasmania	218,197	1,558,494	46,056
Northern Territory.	760,766	6,161	361
Capital	6,275	139,063	274
TOTAL	14,336,673	78,803,261	985,930

There is a considerable interstate trade in live stock, the more settled districts usually receiving more animals than they ship. Part of this movement is due to the attempt to escape the effects of drouth, but there is an underlying commercial movement toward the more settled portions of the country. Unfortunately, the more distant parts of the Northern Territory and Western Australia do not enter into this trade materially as yet.

New South Wales ordinarily receives quite a number of cattle from neighboring states, particularly Queensland. She, however, ships more sheep than she receives, the excess going largely to Victoria. South Australia and Victoria ordinarily receive more of both cattle and sheep than they ship.[34] There appears to be little or no interstate trade in meats.

[32] *Official Year Book*, 1925, pp. 739, 740.
[33] *Ibid.*, 1924, pp. 653, 657, 728.
[34] Inter-State Commission of Australia, *Prices Investigation*, Report No. 7. *Meat.*

CONSUMPTION

The consumption of meat in Australia is heavy. The average annual consumption of beef in the three years ending in 1923-24 was 143.7 pounds per capita. That of mutton and lamb was 71.99 pounds and of bacon and ham 10.82 pounds.[35] This gives a total consumption exclusive of fresh pork, poultry, rabbits and other game, of 226.51 pounds, which indicates an increase over the seven-year period ending in 1922, but somewhat of a decline since earlier periods.[36] The beef consumed at home was 86 per cent of the average annual production of 942,939,000 pounds. The mutton and lamb consumed was 79.9 per cent of the annual production of 507,211,000 pounds and the pork production is almost all used within the Commonwealth.[37]

Australia is well provided with freezing works for the export trade in the better-developed portions of the country. Her railway facilities are considered by the live-stock men to be insufficient for their requirements in getting stock to the seaboard. Since the war the slump in meat prices has affected the industry seriously, but that crisis now appears to have passed. A Meat Council has been formed to improve marketing conditions and extend the market to other countries than Great Britain, which usually takes the largest part of the exports. The greatest export of beef was in 1914 and that of mutton and lamb, while highly irregular, has been decreasing throughout a period of years. The following table shows the exports of mutton, lamb and beef in long tons for the last six years. In addition as many as thirteen million pairs of

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[35] *Official Year Book*, 1925, pp. 667, 671, 740.

[36] Holmes, *Meat Situation in the United States*, United States Department of Agriculture, Report No. 109, p. 273.

[37] *Official Year Book, loc. cit.*

rabbits and hares have been exported within a single year.[38]

Exports of Meat from Australia, in Long Tons[39]

Year	Mutton	Lamb	Beef	Total
1920.....	47,897	15,753	45,798	109,448
1921.....	6,802	11,860	76,518	95,180
1922.....	30,300	40,000	64,500	134,800
1923.....	29,645	23,691	60,926	114,262
1924.....	5,283	15,778	74,853	95,914
1925.....	9,082	16,291	123,392	148,765

British New Guinea

Papua, which is a territory of Australia, and the Territory of New Guinea, which was formerly German and is now administered by Australia under mandate, cover the eastern end of the Island of New Guinea. The Island is in the most torrid position and has an extremely tropical climate excepting in the highlands of the interior. The live-stock industry is not yet, at least, of any importance.

In Papua there were only 368 horses, 2,344 cattle, 1,407 goats, 557 pigs and a few mules and donkeys. In the Territory in 1922, there were 727 horses, 6,972 cattle, 3,404 sheep, 3,955 goats and 5,397 pigs exclusive of the large number of pigs, kept by the natives.[40]

New Zealand

New Zealand is a comparatively small country, but it is one of the world's leading meat producers. It takes first place in the quantity of lamb exported, and in the number

[38] J. H. Carruthurs, "The Rabbit Plague in New South Wales," *Mid-Pacific Magazine*, February, 1925, p. 411.

[39] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1924, p. 14; 1925, p. 15.

[40] *Official Year Book of the Commonwealth of Australia*, 1924, pp. 624, 640.

of sheep per unit of area it easily leads all the countries in the world excepting Great Britain and Bulgaria. It takes a prominent place among the nations exporting beef and is also a very important exporter of wool and dairy products.

NATURAL CONDITIONS

The Dominion consists of two main islands separated by a narrow strait and one moderate-sized island immediately to the south of the others. Several small islands scattered in the neighboring waters of the Pacific are also included politically. The two main islands, which cover about 103,000 square miles, extend in a fairly narrow band in a southwest to northeast direction from 47 degrees to 34 degrees south. Being entirely in the temperate zone and no part of the land being far from the water, the climate is mild, although there is a considerable range of temperature from north to south. The South Island is distinctly mountainous and the North Island has a considerable area covered by high mountains. The southwest coast of the South Island finds the high mountains, called the Southern Alps, close to the sea which enters among them in deep bays like the fiords of Norway. In other parts of the islands there is usually a strip of lower land of varying width between the mountains and the sea. On the east coast of the South Island and on most of the North Island the width of this strip is considerable. The extreme northern part of the North Island is all low. These lower lands contain a few real plains, but, as a rule, they are rolling or hilly in character and are called the Downs from their likeness to the Downs of England. The prevailing winds, filled with a large amount of moisture from the Pacific, arrive first at the mountainous west coast of the South Island and give this region more than 100 inches of rainfall, excepting in the north. Some places

get as high as 300 inches. Needless to say, in such sections forests prevail. The sheltered part of the South Island gets only a moderate amount of water. Usually this is sufficient for the needs of agriculture and the growing of pasturage, although there are occasional periods of drouth. The North Island is more equally supplied with water, the majority of the productive regions getting 50 to 70 inches of rainfall. Originally much of the North Island was covered with a fairly tangled growth of low vegetation or else with forest. In some parts of this island, however, and on part of the coastal strip of the South Island the land was covered with natural grass. All of the flatter country has been plowed and either put into crop or re-seeded with more nutritious grasses than the native variety. Much of the fern and scrub land and some of the forests have also been converted into agricultural lands or artificial pasture.[41]

In 1923 there were 16,258,651 acres under artificially sown grass and 14,739,382 acres in natural grass available for stock feeding in the occupied holdings.[42] The artificially sown grass is chiefly grown from seed imported from England and called "English grass." This will carry about nine times as many head of stock to the acre as the native grasses.[43] Other grass and clover seeds, including alfalfa, are also used in developing the pastures, most of which are fenced.[44]

New Zealand, in spite of the great importance of its pastoral industry, has developed a strong land policy looking toward the subdivision of the land into comparatively

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[41] Oxford Survey of the British Empire, Vol. V, *Australasia,* pp. 375-407.

[42] *New Zealand Official Yearbook,* 1924, p. 394.

[43] W. P. Reeves, "New Zealand," in *British Dominions,* edited by Wm. J. Ashley, p. 82.

[44] H. D. Baker, *New Zealand,* Special Consular Report, No. 57, 1912, U. S. Department of Commerce and Labor, pp. 92-97.

small holdings rather than keeping it in large open ranges. Land taxes have discouraged the retention of large holdings and the government has purchased large blocks of land and leased it to tenants who operate smaller grazing "runs" and farms.[45] This policy appears to have increased the live-stock production.

Sheep raising has been the leading live-stock industry. This appears to be due partially to the natural climatic conditions—the large rainfall and a growing season extending practically throughout the whole year, which favor grazing rather than grain growing. However, sheep raising became firmly entrenched in the country in the early days before modern invention had overcome the worst of the difficulties involved in getting perishable products to distant markets.

THE SHEEP INDUSTRY

The first sheep introduced into New Zealand came from New South Wales in 1841.[46] These were Merinos, the breed which predominated in the country in the early days and which still forms the basis for most of the cross-bred flocks. Until the late seventies there was no means of successfully exporting mutton and lamb to other countries. There was a large local rate of meat consumption, but the only exportable products were wool and tallow and a little of the mutton put up in cans. Many of the carcasses of the old sheep were boiled down for their tallow and everything else wasted. Apparently in many cases not even the tallow was saved. The first commercial shipment of frozen mutton from New Zealand was made in February, 1882.[47] This new outlet for the products

[45] Oxford Survey of the British Empire, Vol. V, *Australasia*, pp. 410-412.

[46] Baker, *op. cit.*, p. 114.

[47] Critchell and Raymond, *A History of the Frozen Meat Trade*, pp. 7-12, 41.

of sheep raising soon revolutionized the industry which thereafter turned its attention increasingly to meat production rather than wool. The chart on page 433 illustrates the change which came over the industry.[48]

The advent of the frozen mutton export trade caused the establishment of the mutton breeds of sheep and the building up of large flocks of crossbreds suited to the production of both mutton and wool. Merinos still persist, partially as a pure breed best suited to the drier lands and the outlying regions on the mountains,[49] and partially as the basis for high-grade crossbred flocks which yield abundance of good wool and produce early maturing lambs of good quality. The most popular of the pure English breeds is the Romney Marsh. However, the New Zealanders have developed a breed of their own which is also very popular. This is the Corriedale, a mixture of Merino, English Leicester and Lincoln.[50] It is now a fixed breed and, in proper conditions, is an excellent producer of both mutton and wool and is especially good for producing market lambs. This breed is particularly popular in the South Island around Canterbury.[51]

The numbers of sheep in New Zealand have shown a fairly steady increase for many years. There are periods of decline, but declines have always been followed by periods of greater increase. The year 1918 was the high-water mark of recent history on both islands. This was probably due to the shortage of shipping facilities during the war which allowed the flocks to be increased. In that year there were 26,538,302 sheep, 14,758,278 of which were in the North Island, 11,780,024 in the South Island.

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[48] *New Zealand Official Yearbook,* 1924, p. 402, and later data.

[49] Baker, *op. cit.,* p. 115.

[50] Marshall, *Features of the Sheep Industries of United States, New Zealand and Australia Compared,* U. S. Department of Agriculture, Bulletin No. 313, pp. 17 *ff.*

[51] *New Zealand Official Yearbook,* 1924, p. 396.

The year 1922 saw the bottom of the postwar decline; since then there has been a steady increase to 24,548,000 head in 1925. The chart on page 435 shows the changes in the numbers of each class of live stock for over half a century.[52]

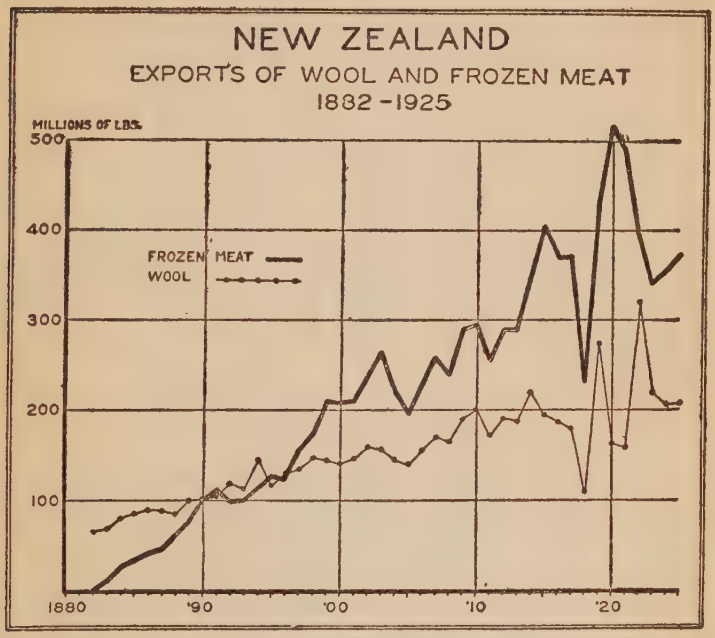

CHART 24.

The sheep industry of the Dominion is quite strongly concentrated on the eastern portion of the islands where there is the least mountainous territory and the rainfall is more moderate.[53] In the North Island the sheep territory also covers the southern end, but does not extend over the

[52] *Ibid.*, p. 396, and later data.
[53] *Ibid.*, maps opposite page 385.

plateau in the north-central portion from Lake Taupo to the Bay of Plenty where the surface of the ground is chiefly volcanic pumice.[54] In the North Island the sheep are almost entirely fattened on grass. On the South Island the feeding of roots is much more common. Turnips and mangels are grown and frequently eaten right off the ground. Rape is also grown. These auxiliary crops are more necessary for the winters of the south. Fencing has been found necessary in controlling the consumption of this fodder as well as the grass, even the root crops being grown in comparatively small paddocks.[55] The growing of alfalfa is not important as yet, but oats are raised for fodder. Sheep farming in New Zealand in many cases is approaching the intensive conditions found in much of the English sheep raising, being conducted on cultivated land.[56] The average size of the flocks is only about 1,000 sheep and more than one half of the sheep are in flocks of less than 500.[57]

THE CATTLE INDUSTRY

Cattle breeding is also important in New Zealand both for beef production and dairying. The chart shown on page 435 indicates that, while the numbers of sheep are not increasing as rapidly as formerly, the numbers of cattle are increasing at a more rapid rate with the passage of years. The total number of cattle, however, was only 3,503,744 in 1925. The cattle are much more evenly distributed over the islands than the sheep are, although there seems to be some tendency for the cattle other than dairy cows to be most common in the sheep areas.[58] There are

[54] Oxford Survey of the British Empire, Vol. V, *Australasia*, p. 385.
[55] Baker, *op. cit.*, pp. 92-97.
[56] Dominions Royal Commission, *Minutes of Evidence, New Zealand*, Evidence of G. R. Marshall and E. Hall.
[57] *New Zealand Official Yearbook*, 1924, p. 398.
[58] *New Zealand Official Yearbook*, maps opposite p. 385.

some strictly beef breeds, but these are not so common as formerly, since dairying has become so common in connection with the smaller farms. The total number of dairy cows and heifers intended for dairying is over one-third of the total cattle, and the production and export of dairy

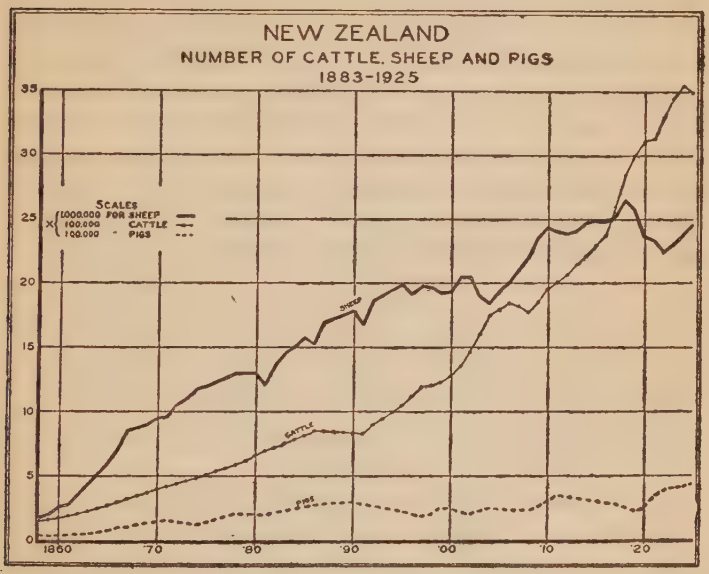

CHART 25.

products is making very rapid strides.[59] Nevertheless, the production of beef is greater than that of mutton and lamb. The beef industry receives less attention in all discussions of this country because beef is largely consumed at home, while mutton and lamb are produced more for the export market. Dairy production also is becoming increasingly focused upon the foreign market. Beef is ex-

[59] *New Zealand Official Yearbook*, 1924, p. 402 *ff*.

ported mainly from the North Island, where there is even considerable "baby beef" produced.[60]

PIG RAISING

Pig raising is unimportant in New Zealand in spite of the development of the dairy industry. There were only 414,271 pigs in the Dominion in 1924. Perhaps one reason for the lack of development of pigs in connection with dairying is the fact that the latter industry devotes so much of its attention to cheese making which leaves but little residue for feed. Grain growing also is unimportant. However, corn can be grown in the North Island and the government wishes to stimulate the raising of pigs with a view to exporting frozen pork.[61] At present less than 1 per cent of the bacon and ham production is exported.[62]

CONSUMPTION

The domestic consumption of meats is heavy. The following table shows the total production, domestic consumption and export during the past decade:

AVERAGE ANNUAL MEAT OPERATIONS OF NEW ZEALAND IN THE LAST DECADE[63]

Product	Production,* Pounds	Consumption, Pounds	Export, Pounds
Mutton	251,680,750	102,721,950	148,958,800
Lamb	125,373,640	17,631,900	107,741,740
Beef	259,827,270	186,541,530	73,285,740
Pork products †	30,165,500	29,995,500	170,000
TOTAL	667,047,160	336,890,880	330,156,280

* Including estimated farm slaughter.
† Pork, bacon and hams.

[60] *Supplements to Commerce Reports,* U. S. Department of Commerce, "New Zealand," 1917.
[61] *Foreign Crops and Markets,* May 7, 1924, p. 383.
[62] *New Zealand Official Yearbook,* 1924, p. 411.
[63] *Ibid.,* pp. 407, 408, 411; and *Report on the Trade in Refrigerated Beef, Mutton and Lamb,* Ministry of Agriculture and Fisheries (London, 1925), pp. 48-50.

The equality between home consumption and exports of all classes of meats taken together is striking. When these figures on consumption are divided by the average population during the period, an average per capita consumption of all meats during the decade is found of 307 pounds. In this total, mutton accounts for 93.5 pounds, lamb for 27.5 pounds, beef for 169.5 pounds and pork for 27.5 pounds. The consumption is not regular from year to year and the general trend is downward.

EXPORT TRADE

The exports of meat go almost exclusively to Great Britain. In the year 1924 only 32 tons of mutton, 191 tons of lamb and 5,426 tons of beef were shipped to other markets, chiefly Belgium and Holland. The total exports for the last five years were as follows:

New Zealand Exports of Frozen Meats, in Long Tons[64]

Year	Mutton	Lamb	Beef	Total
1920.....	121,051	69,225	37,894	228,170
1921.....	104,038	62,906	45,290	212,234
1922.....	69,817	77,230	25,551	172,598
1923.....	38,375	74,106	36,736	149,217
1924.....	50,450	73,413	32,413	156,276
1925.....	54,111	75,914	35,300	165,325

Under the Meat-Export Control Act of 1921-22 a Meat-Producers' Board has been formed to control the export of meat in the interests of the producers. This board has done much to improve the grading and other marketing practices in the export trade. Freezing houses or packing plants are scattered around the coast of the country so that no producing point is far from a slaughtering center. This

[64] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1924, pp. 14, 15; 1925, p. 16.

saves any lengthy movement of live stock, and the opportunity for the refrigerated steamers to stop at many points all along the coast made this localized packing possible. Many of these plants are coöperative and run under local management. Owing to the fact that the slaughtering is a highly seasonal matter, the plants are utilized up to capacity for only a small portion of the year.[65] In such circumstances it is a question if the country is not oversupplied with freezing plants for the greatest efficiency. Recently some of the smaller concerns, particularly cooperative companies, have been experiencing financial difficulties and there is a movement on foot for a certain degree of amalgamation of the business and lessening the numbers of plants in operation.

The South Pacific Islands

None of the islands of the South Pacific is large enough to develop any important meat trade. Nevertheless, their capacity as producers and consumers is by no means negligible.

The best accounts available indicate that the local livestock industry is increasing in importance. The cattle in the Fiji Islands increased from 49,000 to 59,000 between 1913 and 1922. In the latter year there were also 2,000 swine, 1,000 sheep and 17,000 goats in the Fijis.[66] The supply of beef in Fiji exceeds the demand and a few head of cattle are shipped to Tonga and Samoa. Beef is also supplied to passing ships for their stores. The cattle are small as a rule. British breeding stock and Indian Zebus have been imported.[67] During the war, cattle were ex-

[65] *Report on the Trade in Refrigerated Beef, Mutton and Lamb.*

[66] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1033.

[67] W. Rainey, *Livestock Industry in Fiji,* agricultural circular issued by Department of Agriculture, Fiji.

ported to Australia, but this trade has not been maintained. Cattle are raised on the coconut plantations where they keep the weeds and other herbage under control. There are also other good grazing lands.[68] The so-called dry area receives no rain during about five months of the year, and the feed for live stock is not dependable. The best of these lands is used for sugar cane, which finds sufficient water in the seasonal supply. The wet areas have good grazing all the year and carry most of the stock. Fiji, like many others of the South Sea Islands imports bacon and hams and some live pigs to supplement the local production which has not been developed as far as it might be.[69]

In 1920 there were approximately 120,000 head of cattle in New Caledonia, and attention was also being devoted to live stock in Tahiti and the adjacent French Islands. Durhams and Ayrshires have been imported. New Caledonia has large areas of virgin land suitable for carrying stock, and meat-canning factories have been established which export their products to the neighboring islands and to France. The output of these factories was 817 tons in 1912.

In spite of the important local production of meats on these islands, Australia has found them an important market for her meats. This trade is growing and the natives are becoming greater consumers of meat.[70]

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[68] Interstate Commission of Australia, *British and Australian Trade in the South Pacific,* Australian Government Report, 1917-18, pp. 96, 97.

[69] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Vol. I, Part II, p. 67.

[70] Inter-State Commission, *loc. cit.*

CHAPTER XI

SOUTH AMERICA

South America is a very important factor in the world meat situation. This continent has been for several years the leading source of beef shipments and also exports large quantities of mutton and lamb. There is but little pork industry as yet.

The only part of the continent which has experienced any real development as yet is the Argentine Republic. Many of the other countries have been settled by the white man for a considerable period, but their progress has, as a rule, lagged behind that of the northern world. It is no wonder, for most of South America lies within the tropics, and man has found it easier to develop the temperate regions of the earth first. The enormous valley of the Amazon River is extremely fertile, but its tropical location makes its exploitation a difficult matter. Disease and the excessive productivity of the torrid climate must be conquered before civilized men can make any worthwhile use of such regions. To-day these difficulties seem insurmountable to many leading thinkers, but when the need for the use of tropical lands arrives it may be found that the development of such regions will involve no greater difficulties in comparison with current knowledge and facilities than the development of the temperate regions did in its time. The establishment of the Panama Canal Zone involved comparatively less human suffering than the establishment of the first white colony in New England. The natural resources are present in abundance

in the tropics and it is probable that man will learn how to use them when the need arises.

Much of South America has a fairly temperate climate either on account of its latitude or its highland character. Proximity to the tropics makes it more difficult in many of these regions to avoid troubles from animal diseases. However, it is not very difficult to establish animal quarantine boundaries and the live-stock industry will eventually flourish in many of these more temperate sections. A large proportion of the plateaus and mountainous regions will sometime be important meat producers.

South America, as a whole, will probably never be as desirable a location for the residence of civilized men as the temperate regions of the northern hemisphere. For this reason, if for no other, it will probably continue to be a source of meat for the outside world. Geographical specialization of industry must continue to a certain extent, and so long as it does continue much of this continent will probably be better fitted for meat production than many other types of economic activity. It may be anticipated that South America will continue to produce a surplus of beef, and it will be strange if the hog industry does not assume importance within but a few decades in much of the area so well suited to corn growing.

Argentina

The Argentine Republic has been the world's leading exporter of beef for many years and its exports of mutton and lamb are second only to those of New Zealand. Apparently this leading position will be retained for some years, for the exports are growing and there are no close rivals in the field.

According to the census of December, 1922, there were 37,065,000 cattle, 36,209,000 sheep and 1,437,000 swine

in the country. The central province of Buenos Aires contains 42 per cent of the cattle and 34 per cent of the sheep. All census data for the live stock of this country are questioned because of the difficulty of getting a complete count of the animals, but there seems to be no question but that the cattle are increasing and the numbers of sheep are fluctuating within considerable limits with a general tendency to decrease throughout a long period of years.

In area the country is about two-fifths the size of the United States. In shape it is long and fairly narrow, extending from within the torrid zone on the northern boundary near Bolivia for over 2,000 miles southward to the south of Tierra del Fuego, which is as far south of the equator as the south of Sweden is north. There are four fairly well-defined regions in the Argentine from the viewpoint of agricultural production. In the north is a subtropical region which at present is largely in forest but which now produces sugar cane and other agricultural and live-stock products and will eventually produce much more. South of this is the region of the pampas, or prairies, which extends from about the 30th parallel to the 40th. This is a fairly level plain composed of deep fertile soil and is reasonably well watered. Toward the Andes on the west side of the pampas there is less rainfall and near the foothills there is an irrigated vineyard-growing region. South of the pampas is Patagonia, which is higher and drier land, fairly rugged in places and cooler by reason of its latitude. It is the central region, the pampas, bordered by the ocean and the River Plate, that is the most productive region as yet.

The people in this country are primarily of Spanish extraction, but many Italians and some other Europeans and Orientals have entered within recent years. In Patagonia there are but a few inhabitants of any race, but

comparatively speaking there are many British engaged in sheep ranching. The whole country has been developed distinctly on the basis of large-scale land ownership. The day of the breaking up of these large holdings is not in sight except in the more densely settled districts near the cities.

Cattle are said to have been introduced into the Argentine in the sixteenth century from Brazil and Peru. Horses and possibly cattle and sheep were also brought direct from Spain. These animals were all at least of Spanish origin and formed the basis of the original herds which at one time roamed wild on the plains. These animals had few qualities to their credit but their hardiness and ability to resist disease. The first export from the country after the founding of Buenos Aires in 1580 consisted chiefly in hides and tallow and these, with wool, were the chief exports of animal produce for many years. Eventually "jerked beef" was added to the exports.[1] This dried meat has been a popular article of diet among the frontiersmen of all Latin America, its popularity being due to its keeping qualities. During the first part of the last century this "jerked beef," or "tasajo," together with hides and tallow, formed the chief output from the live stock. The introduction of this dry-salting in the middle of the eighteenth century, doubtless, was some help to the industry, but there was no great improvement for another hundred years.[2] About the middle of the last century, when political conditions became quieter, interest arose in the importation of foreign breeding stock to improve the native animals and make them capable of being sources of products of first-rate value to the commercial

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[1] "Argentina, Its Agriculture and Livestock in 1910," *Anales de la Sociedad Rural Argentina*, pp. 1, 2, 76.

[2] A. M. Bergman, *A Review of the Frozen and Chilled Trans-Oceanic Meat Industry*, p. 23.

world. The native, or "Criollo" stock was no good as a milk producer and its small size and other poor characteristics rendered it indifferent as a meat animal. The first new blood was introduced in the sheep about 1836 when fresh Merino stock was imported. A Shorthorn bull imported in 1848 led the way in improving the cattle. From then on the movement for building up better stock expanded.[3] The introduction of refrigeration in the ocean carriage of meat about 1880 and the final subjugation of the native Indians about the same time gave a powerful impetus to this movement, for the former opened up the markets of Europe to the meat of the Argentine and the latter secured the European inhabitants in their possession of the land. In 1908 the census showed that 3.88 per cent of the cattle were purebred and 51.72 per cent improved crossbreeds in the whole country, while in the province of Buenos Aires these figures were 6.28 and 85.08 respectively. Of course, there has been a continued improvement since then. The outstanding new beef breed is the Shorthorn, followed by the Hereford and Polled Angus. The preponderance of the new blood in the cattle comes from British breeds, although some continental animals have been introduced. The new sheep breeds are also chiefly British, but the Merinos take a large place in the flocks. Argentina has taken the question of building up good stock very seriously. Her live-stock exhibitions, promoted by the Argentine Rural Society, are unexcelled, and she has developed strains of foreign pure-bred stock that are in the first rank.[4] As a result, her flocks and herds are the source of meat of excellent quality as well as being economical producers.

The cattle of the pampas have been largely improved

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[3] "Argentina, Its Agriculture and Livestock in 1910," *op. cit.*, pp. 1, 2.

[4] *Ibid.*, pp. 12-64.

by the introduction of imported breeds. As already noted, only 8.64 per cent of the cattle in the Province of Buenos Aires were of the pure native stock even in 1908. The native "Criollo" cattle are found chiefly in the frontier regions on the north and west. The predominant new breed is the Shorthorn. Other breeds, less exacting in requirements for good development, are used more on the poorer sections of the pampas and in the northern districts. Herefords and Polled Angus cattle are popular in the provinces of Entre Rios and Cerrientes.[5] Among the sheep, the Merinos are retained to a considerable extent, but the most popular breed is the Lincoln, other British breeds also being raised in fairly large numbers.[6]

The district of the pampas leads in the production of live stock. This was the first district to be settled and, since natural conditions there are most favorable for man and beast, animal industry has reached a high degree of development. These plains, which are supposedly an old sea bottom, were never wooded but were covered with coarse grasses, which were tall and suitable feed for cattle and horses, but did not by any means produce the quantity and quality of forage for which the land was suited. In early times the Spanish colonists introduced what were called the soft grasses, which included clovers. Even these soft grasses, while superior to the natural vegetation for meat production, were only an indifferent class of forage. Within comparatively recent years, alfalfa has been introduced and has worked a revolution in the feeding of stock. This alfalfa is used principally as pasture, only a small portion of it being cut for hay and less for ensilage, and vast areas of it are fenced off into

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[5] G. A. Rommel, *Notes on the Animal Industry of Argentina,* Twenty-fifth Annual Report of the U. S. Bureau of Animal Industry, p. 319.

[6] Bergman, *op. cit.,* p. 19.

large fields in which the stock graze. The first steel fence was introduced in 1844.[7] Now tracts as large as 50,000 acres or even more are fenced off into sections or paddocks of 10 to 20 acres in extent. It is customary to cut the fields up into these sections so that the closeness of cropping by the stock may be controlled. Alfalfa gives the best results when the grazing is controlled and not allowed to be eaten off too close. The ranchmen of Argentina also classify their cattle on these grazing lands and place animals of similar type together in separate paddocks.[8] Alfalfa is now being grown on a very wide area in the country. It is important even in the northern part of Patagonia, in the provinces near the Andes and in some of the warm northern provinces. Its greatest development is in the central provinces of the pampas. However, this plant is not yet being grown as extensively as it might be. Alfalfa will support several times as many animals to the acre as the poorer grasses and even for fattening only 3 to 3½ acres per year are used for each steer.[9]

Meat-production, even on the pampas, is almost exclusively a grazing business, although no longer on the unfenced open grazing. The cattle and sheep are bred and raised in the fenced pastures and fattened there chiefly on alfalfa. To a certain extent the poorer stock of the outlying regions toward the south are brought to the pampa grazing lands for finishing, as they are to the Corn Belt in the United States, but the finishing is on alfalfa and not on grain. Argentina grows great quantities of corn and other grain for feeding the live stock of other nations, but her own stock eat very little of it. The fresh pastures of the

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[7] Bergman, *op. cit.*, p. 22.
[8] Rommel, *loc. cit.*
[9] A. D. Melvin, "The South American Meat Industry," *Yearbook of U. S. Department of Agriculture*, 1913, p. 357.

pampas put a finish on the animals that makes their meat very acceptable even in the highly discriminating English markets. Most of the animals finished on the pampas are raised there. The shipment of feeders from the newer regions of the north meets the same difficulty that confronted the shipment of Texas steers to the north of the United States in the early days. The animals in these warm districts are frequently infested with ticks and infected with "Texas fever." [10]

The pampas are found at their best in the east-central region round about Buenos Aires. Toward the west the elevation grows greater and the rainfall becomes less. There appears to be ample water in all parts of the pampas at varying depths below the surface of the ground. This water comes partially from local rainfall and partially, particularly near the Andes, from the rivers flowing down the eastern slopes of these mountains. In some cases the rivers disappear entirely in the west, emptying into salt lakes or marshes. Needless to say, when the soil and sub-soil are full of soluble chemicals, much of the water pumped from these subterranean reservoirs is acceptable to neither man nor beast. In much of the country, however, good water pumped from wells is abundant.

Going northward through the country toward the frontier the pampas are left behind. The central part of this northern region is part of the basin of the Plate system of rivers. In the extreme north is the Gran Chaco which is partly wooded and partly swampy. Some of these swamps are thought to be the remainder of the prehistoric Pampean Sea although the general level of this district is well above sea level and the present swampiness comes merely from the sluggish flow of the rivers. Southward between the Parana and Uruguay Rivers the land

[10] Bergman, *A Review of the Frozen and Chilled Trans-Oceanic Meat Industry*, p. 35.

is at first like the Chaco but becomes higher and undulating toward the lower part of the rivers in the province of Entre Rios. The northeastern area of the country belongs to the Brazilian highlands and the northwestern districts have the Andes on the west and are interspersed with various mountain ranges. The valleys between the ranges are salty and marshy. Nevertheless, in practically all of this northern country there is already a considerable development of the live-stock industry, and alfalfa is grown to a noteworthy extent as well as corn and other grain.[11]

In this north country there are few sheep and the Criollo cattle, more or less improved with the addition of foreign blood, form the mainstay of the animal industry. All through this district fever and other diseases must be combatted. Nevertheless, the industry is growing in the whole Chaco district. As the forests are cut the underbrush is burned and the grass grows up. In time the grass is improved and alfalfa is now introduced extensively. The north is potentially a rich territory, but nature requires more assistance or control there than she does on the pampas.

The Patagonian region of the south is dry and cold. Much of this district is relatively barren. The prevailing winds are westerly and in the northern part of this district the Andes are sufficiently high to take practically all the rains before the sheltered plains are reached by the winds. In the southern part the mountains to the west are not so high and the country gets more rainfall. Nevertheless, the province of Chubut in the north has more human beings to the league than does Santa Cruz in the south. This district and the pampas are in great contrast in every way. In Patagonia the sheep predomi-

[11] Pastoral and Agricultural Map published by the Ministry of Agriculture of Argentina, 1918.

nate over the cattle. The cattle become fewer toward the south and the sheep increase. In the province of Rio Negro near the true pampas there were 90,957 cattle and 2,802,282 sheep according to the census of 1914. In Santa Cruz, the most southerly province on the mainland, there were only 43,521 cattle and the sheep numbered 3,940,616. In the extreme south on the island of Tierra del Fuego, which has excellent natural conditions for sheep, the concentration of these animals is even greater than on the south of the mainland. Alfalfa is grown only in the north and the sheep are raised on immense ranges. The sheep are chiefly the English breeds.

RELATION OF OTHER AGRICULTURAL DEVELOPMENTS

The development of Argentina's dairy and hog industries has been relatively small. The census of 1922 shows only 1,437,000 swine in the whole country. This is remarkable in view of the fact that this country is one of the largest corn producers in the world. The dairy industry is not fully developed, but definitely on the increase, and growing more rapidly to-day than any other animal industry in the Republic.

The number of dairy cows is less than 10 per cent of the total number of cattle.[12] Nevertheless, there has been a marked tendency during recent years to increase dairying. During the first decade of the century there was no particular net increase in butter production and the exports declined slightly. Cheese production increased just about enough to provide for the expansion in the home demand. Just before the war there was a tendency to increase both butter and cheese production. Butter had been on a net export basis for years, but cheese had been imported in considerable quantities. In 1917 there was

[12] T. R. Pirtle, *Handbook of Dairy Statistics*, p. 43.

a very marked increase in the production of both butter and cheese, largely for the export trade. In that year the cheese trade turned from an import to a net export basis.[13] The postwar years show a marked increase in the export of both products.[14] Whether or not this is a permanent movement will be more clear after the results of the recent beef depression, which stimulated dairying, have been forgotten. However, butter and casein exports have forged steadily ahead while the cheese export trade of Argentina has disappeared under the competition of the principal cheese-manufacturing countries where the industry has returned to its pre-war status.

In Argentina, meat production is largely a competitor of, rather than an assistance to, agriculture in the narrower sense. Grazing on artificial pastures is conducted side by side with grain raising. In the early development of this country, as has generally been the case in all very new frontier regions, the live-stock industry afforded the only products for export. Those were the days of grazing on the open range. Later the growing of wheat and corn for export became important and animal husbandry found a competitor. In such a stage of development the actual numbers of stock may decline for a time. The Argentine statistics of live-stock population are hardly dependable enough to tell with certainty to what actual extent the numbers did change temporarily. Apparently cattle declined slightly from 1888 to 1895.[15] They may have decreased also from 1908 to 1914, but that is not certain in spite of the census figures, which are admittedly incomplete for 1914.[16] There seems to be no question but

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[13] Ernesto Tornquist and Co., *The Economic Development of the Argentine Republic in the Last Fifty Years*, pp. 46, 47.

[14] *Foreign Crops and Markets*, Feb. 6, 1924, p. 138.

[15] Martinez and Lewandowski, *The Argentine in the Twentieth Century*, p. 169.

[16] Ernesto Tornquist and Co., *op. cit.*, p. 265.

that the number of sheep has declined markedly since 1895. The third phase of the comparative development of raising animals and tilling the soil is likely to see a renewed interest in the former under more intensive conditions. Instead of having live-stock production intimately connected with tillage and depending largely upon the feeding of grain, this stage of development in Argentina finds the stock fed on semipermanent pastures of alfalfa. Owing to the fact that the animals can graze in the open all of the year, it has been possible to promote this semi-intensive method of feeding stock which utilizes the soil resources in a fairly efficient manner. The chief connection between tillage and animal husbandry seems to lie in the initial establishing of the alfalfa pastures. It is customary for the virgin prairie to be broken up first by tenant farmers who raise grain for several years and sow alfalfa with the last seeding of grain. When the pastures need to be renewed this process is repeated, but definite crop rotation is not yet the general practice and alfalfa pastures once established, when properly cared for, may be used for many years.[17]

The relative growth of the two industries cannot be measured properly by a comparison between grain production and the mere change in the live-stock population. Within the last half century so much has been done in improving the animals that a three- or four-year-old steer will yield a carcass of very much greater weight than one of twice the age from the Criollo herds at the beginning of the period would have yielded. As a consequence the meat production of a given number of animals enumerated by the census at the end of the period might easily be fourfold that of the same number in the beginning. The following table presented by Shanahan,

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[17] Bergman, *op. cit.*, p. 14.

shows something of the actual changes in a form sufficiently exact to illustrate the real facts:

RELATIVE INCREASE OF NUMBER OF LIVE STOCK AND PRODUCTS IN ARGENTINA[18]

	1895	1908	1911	1914
Total "cattle units" (million)	35.3	42.5	46.3	37.7
"Cattle units," per capita	8.9	6.9	6.5	4.6
	1901	1905	1910	1912
Meat exports (tons)*	171,370	347,003	372,003	510,510

* Live animals included on basis of estimated weight.

The growth in the exports is so strikingly large in the somewhat shorter time than that given for the changes in the total "cattle units" that it is unnecessary to reconstruct this table to give closer comparisons. The fluctuations in export before the war and the domestic consumption are not sufficiently important to vitiate the proof that the meat production nearly tripled while the numbers of all stock, including sheep, reduced to "cattle units," made but little net advance in total figures and decreased very much in proportion to the human population.

Another side light is shed on the comparative growth of tillage and animal husbandry by the statistics of grain acreage and alfalfa. The latter crop is by no means a perfect index of the development of live stock. In earlier years more cattle were fed on natural grass. On the other hand, the alfalfa pastures of to-day are more productive than those of earlier years. Certainly it may be concluded that the change in the acreage of alfalfa is a good index of the development of the semi-intensive animal industry which has come as the third stage of the utilization of the land. The following table shows very clearly that this

[18] E. W. Shanahan, *Animal Foodstuffs*, p. 57.

type of animal husbandry has expanded much more rapidly than the extensive tillage represented by grain growing for export:

RELATIVE GROWTH OF ALFALFA AND GRAIN ACREAGE IN ARGENTINA.[19] FIGURES IN THOUSANDS OF HECTARES

Date	Wheat	Corn	Alfalfa
1899 – 1900	3,250	1,009	1,268
1903 – 1904	4,320	2,100	2,172
1908 – 1909	6,063	2,973	3,687
1913 – 1914	6,573	4,152	6,690
1918 – 1919	6,870	3,339	8,073

EXPORT TRADE

The table on page 454 shows the exports of frozen and chilled, "jerked" and canned beef since the end of the last century. The distribution of the shipments of the first class shows clearly that the United Kingdom has always been the best customer, but during the war and again very recently other countries, mainly on the continent of Europe, have been important customers.

The detailed export data show the chilled beef shipments appearing as a separate category in 1908. These shipments amounted to over 37,000 tons, chiefly to Great Britain before the war. In 1918 and 1919 practically all the beef moved in a frozen condition. Since then the chilled trade has revived and nearly one half of the beef moves in this unfrozen, but refrigerated, state.

The exports of jerked beef are diminishing, but the data on exports of the finished product fail to show the full importance of raising animals for this purpose. It is said that the slaughtering of animals in the whole Plata Valley for this product was diverted to Uruguay rather than

[19] Ernesto Tornquist and Co., *op. cit.*, p. 28.

having decreased as much as appearances indicated up to the year 1910. Many of the Criollo cattle from the

EXPORTS OF BEEF FROM ARGENTINA
(*Short Tons*[20])

Year	Frozen and Chilled				Jerked	Canned
	United Kingdom	United States	Other Countries	Total		
1899	10,008	.....	.....	10,008	21,124	2,002
1900	27,106	.....	.....	27,106	18,132	1,549
1901	47,946	.....	1,552	49,498	26,781	1,043
1902	59,967	.....	17,214	77,181	24,586	1,812
1903	66,816	.....	23,044	89,860	14,320	4,125
1904	89,849	.....	17,894	107,743	12,926	2,677
1905	140,778	.....	27,720	168,498	27,875	2,743
1906	150,469	.....	19,074	169,543	5,126	1,388
1907	144,858	.....	7,504	152,362	11,738	1,758
1908	195,683	.....	3,630	199,313	7,330	1,904
1909	230,959	.....	1,248	232,207	12,811	7,044
1910	277,952	.....	1,710	279,662	10,408	13,318
1911	331,787	.....	13,050	344,837	13,360	16,990
1912	361,918	.....	16,006	377,924	9,727	19,510
1913	391,385	3,581	8,729	403,695	4,310	13,860
1914	339,785	65,390	1,539	406,714	2,620	14,426
1915	329,724	44,162	25,960	399,846	235	35,212
1916	395,062	9,744	66,647	471,453	1,233	49,128
1917	312,612	1,536	121,081	435,229	8,392	111,094
1918	306,209	768	239,339	546,316	3,064	210,539
1919	323,188	2,018	116,520	441,726	8,801	136,989
1920	385,601	7,132	66,158	458,891	2,788	15,484
1921	390,634	547	38,608	429,789	2,927	17,549
1922	430,052	1,423	22,410	453,885	6,683	40,476
1923	503,117	692	81,908	585,717	5,104	75,072
1924	576,879	2,692	254,011	833,581	17,158	89,769
1925	509,837	120	232,648	742,605	14,359	77,332

northern provinces find their way to the jerked beef and extract factories of this neighboring country and this industry in Argentina, Uruguay and Brazil combined, had decreased but slightly up to 1910.[21] Since then it has

[20] G. B. L. Arner, *The Cattle Situation in Argentina*, mimeographed report, U. S. Department of Agriculture, 1924, pp. 50-52, and later data.

[21] "Argentina, Its Agriculture and Livestock in 1910," p. 79.

become of less importance. The northern Criollo cattle are used for the manufacture of beef extracts as well as for jerked beef.

The export of mutton and lamb in 1924 amounted to 182,353,000 pounds. This was a record shipment except for the year 1911.[22] Most of this mutton and lamb goes to Great Britain, since the Continent does not have a large demand for this kind of meat. During these last twenty years the output of mutton from the pampa district has decreased, while that of lamb has increased.[23]

The export of pork is not important. It appears mostly as frozen pork. In the year 1922-23 it amounted to 13,012,000 pounds; since that year the amount of this export has decreased.

Argentina is amply supplied with facilities for marketing its animals. Packing plants, known locally as "frigorificos," have been established for many years at the principal seaports and cities on the main river system. At one time the export of live cattle was very important, but Britain, the chief market, objects to imports of live animals for fear of introducing animal diseases. Moreover, the export of the carcasses is much more economical than that of live animals. The development of the traffic in frozen meat in the eighties and that in chilled meat at a later time solved most of the physical difficulties of reaching the foreign markets. There has not always been satisfaction with the operation of the packing system which takes the animals from the producers and ships the meat. Like all other middlemen, the packers get all the blame for unsatisfactory prices and other market troubles. This packing industry is controlled chiefly by American and British concerns and only one of the eight principal com-

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[22] *Foreign Crops and Markets,* May 18, 1925, p. 595.

[23] Weddell and Company, *Annual Review of the Frozen Meat Trade* (1924), Supplement No. 1.

panies is considered to be in the hands of local capital.[24] The American packers entered this field in 1909 and commenced to build up their own business. About this time the export of chilled beef was started. In 1912 competition raised the prices of cattle by 50 per cent and the slaughterings were greatly increased.[25] It is an open question whether or not this keen buying actually depleted the herds or whether the census of 1914 understated the actual numbers of cattle then in the country.

After the war the live-stock industry was plunged into a great depression. War prices had inflated the costs of production and it was impossible to keep up the high prices when the stringency had passed. It is probably fortunate that the local price could not rise relatively as high during the war as the London price on account of the high freight rates in force during that time. Such inflation as did occur has had sufficiently serious results. It was not so fortunate that in the postwar period up to the end of 1923 the local price sagged below its pre-war relation to the London market. However, the world's markets were, from the money standpoint, overloaded with meat. It was technically what is known as a "buyers' market." The producers got very low prices—even below the pre-war level. There was great distress in the country as a result. Various expedients, political and otherwise, were adopted. Artificial price fixing was the most drastic and unfortunate attempt. It resulted in a temporary closing of the packing plants and a still greater price slump when price fixing was given up and the plants opened again.[26] Toward the end of 1923 prices began to rise on account of general market conditions. By the middle of 1924 the market had risen 50 per cent owing to

[24] Arner, *op. cit.*, p. 40.
[25] Bergman, *op. cit.*, p. 26.
[26] Arner, *op. cit.*, pp. 6-8.

improved foreign demand and local shortage of supply based upon the mixed causes of an increase of grain growing and dairying at the expense of beef production and a dry spell which hurt the pasturage.[27] It is now generally considered that the depression has passed.

DOMESTIC MEAT CONSUMPTION

The domestic consumption is very important in spite of the fact that the country has only 9,000,000 inhabitants. According to a local authority, Richelet, the average per capita consumption in the year 1912 was about 282 pounds.[28] In 1919 the Director of National Statistics computed that the annual per capita consumption was 198 pounds, which signified a great decrease since the end of the last century. Of the three kinds of meat, about 1,346,500,000 pounds of beef, 257,500,000 pounds of mutton and lamb and 59,500,000 pounds of pork were consumed.[29] Detailed statistics for the years 1914-1918 indicate that the consumption of beef was maintained for that brief period in gross amount only and not in per capita average, while that of mutton and lamb and pork increased per person.[30] The per capita consumption of the city of Buenos Aires in the year 1925 has been estimated officially at 264.18 pounds of beef, 30.49 pounds of pork, and 15.77 pounds of mutton, or a total of 310.44 pounds. The average consumption of all meats in the whole nation is placed at 220.65 pounds.

On the ranches, or "estancias" as they are called locally, the consumption of meat is very high. In the north, much jerked meat is consumed, but in the remainder of the coun-

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[27] Weddell and Company, *op. cit.*, p. 16.

[28] Juan Richelet, "Salvaguardando nuestra ganadería," *Revista zootecnica*, 1912, p. 708.

[29] Ernesto Tornquist and Co., *op. cit.*, pp. 271, 272.

[30] *Ibid.*, p. 111.

try the meat is usually eaten fresh. "The most usual national dishes are *asado,* meat roasted at a coal fire; it is very palatable; *puchero,* meat boiled with vegetables; *lochro,* fresh or salted meat boiled with maize. On more festive occasions in the country districts, *carne con cuero* is served, consisting of meat roasted with the hide on."[31] The city of Buenos Aires is supplied with an up-to-date city abattoir where meat chiefly for local consumption is slaughtered under modern sanitary conditions and with adequate inspection against possibility of disease.[32] Nevertheless, the quality of the meat going through this abattoir and the local meat shops is inferior to that exported. It is leaner and comes from smaller animals, and is used very soon after killing. It would appear that the quality of the meat used locally was tending to improve, for in the five years 1914 to 1918, inclusive, the beef animals slaughtered for home consumption grow decidedly smaller.[33]

THE FUTURE OUTLOOK

The future of the meat industries of the Argentine is bright. The output is continuing to grow with a fair degree of rapidity and the main trouble within recent years has been to find a profitable market for the product. The country has by no means reached its productive capacity and costs of production are relatively low but tending to increase.[34] Moreover, the raw materials to form the basis for an industrialization of the country are not available in any important quantities. The main questions for the near future are the extent to which dairying will encroach on the meat industry and whether grain will continue to be

[31] Bergman, *op. cit.*, p. 39.
[32] "Argentina, Its Agriculture and Livestock in 1910," *Anales de la Sociedad Rural Argentina,* pp. 82-86.
[33] Ernesto Tornquist and Co., *op. cit.*, pp. 110, 111.
[34] Arner, *op. cit.*, pp. 42-46.

exported for the animals of other lands or used for feeding to the local stock. The present tendency seems to be to increase alfalfa pastures rather than to feed grain.

Uruguay

Uruguay is situated just north of the River Plate, between the Uruguay River and the Atlantic Ocean. The country is small, containing only 72,153 square miles. Its northern limit is on the 30th parallel and its southern on the 35th. Since it is on the southern end of the great southern Brazilian plateau and is close to the ocean, its climate is very temperate and healthful. The mountains are not high and there is an ample rainfall. The land is generally slightly rolling, with many broad plains and an abundance of good water. The natural grass is fairly good, which is fortunate, for alfalfa growing does not meet with as great success as it does in the level sections of Argentina.

The live-stock industry is the country's leading enterprise, about 98 per cent of the exports being animal products.[35] Sixty per cent of the land is devoted to stock raising, 20 per cent to mixed farms and ranches and only 5 per cent to agriculture in the narrower sense. A census for 1924 showed 8,432,000 head of cattle which, taken in conjunction with statistics for former years, indicates a steady increase in the cattle population. The statistics on the number of sheep appear to be erratic. Prior to 1908 the highest estimate for any year was about eighteen and one half million in 1900 and in 1903.[36] A census taken in 1908 reported 26,286,276 head, but estimates for 1916

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[35] Harrell and Morgan, *The Livestock Industry of Uruguay and Paraguay,* U. S. Department of Agriculture, Bureau of Markets, Reports on Foreign Markets, No. 41.

[36] Holmes, *Meat Situation in the United States,* U. S. Department of Agriculture, Report No. 109, p. 207.

showed only 11,473,000.[37] Even this latter number gives a very large number of sheep to the square mile of total area. Weddell estimates that there were approximately 17,000,000 in 1924,[38] although the census for that year showed only 14,443,311 sheep. The density of cattle population is also high, being over four times that of the Argentine and greater than that in any country in North or South America.[39]

The cattle of Uruguay were originally the Criollo stock, but within recent times considerable effort has been made to improve the herds by the importation of foreign breeding animals. Especially in the south, where the farmers are Europeans, Shorthorn, Hereford and other breeds have been introduced. The quality of the stock for slaughtering purposes has been improving steadily during recent years. The carcasses are smaller than those of the Argentine cattle, but the recent slump in the market demand for canned meat has turned the attention of the *estancieros* to better breeding and feeding so that the cattle may meet the standards required by the British chilled beef trade. The proportion of the cattle in the country suitable for this trade was said to be 18 per cent in 1921 as compared with only 4 per cent a few years before.[40] The cattlemen of Uruguay have not made a common practice of feeding concentrated feed to their stock in spite of the fact that the country produces a small surplus of linseed and other protein concentrates as well as of wheat and corn for export. Another concentrated feed exported

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[37] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1036.

[38] Weddell and Company, *op. cit.,* 1924, pp. 17-18.

[39] *International Yearbook of Agricultural Statistics,* 1909-21, pp. 237-243.

[40] Weddell and Company, *Annual Review of the Frozen Meat Trade,* 1921, p. 19.

for the use of animals in other countries is meat meal which is a by-product from the local meat-packing industry. Oil cakes, brewers' grains and other feeds are used for dairy cattle and show animals, but are not used extensively for meat-producing stock.[41]

The cattle industry is found in all parts of the country, but it is most important in the departments of Salto, Paysandu and Rio Negro which lie along the Uruguay River. North of the Negro River the country is infested with the cattle tick. Efforts are being made to eradicate this completely, but only the districts south of this river are as yet classed as tick-free. A mild form of foot-and-mouth disease is prevalent over the whole country. Sheep breeding is general, as practically all ranches handle cattle and sheep together, but its most important development is in the department of Duragno in the center of the country and in Soriano near the mouth of the Uruguay River. The dairy industry has some importance, but dairy products are on the import basis. The swine industry makes but a poor showing as yet, but is increasing as true agriculture with moderate-sized farms encroaches on ranching.[42]

In the past the main market for cattle has been for Liebig's meat extract and for the *saladeros* which make jerked beef. The numbers of cattle slaughtered for the latter product increased until the year 1905-06 when the number for the year stood at 909,600 head.[43] By the year 1915 the number so utilized had fallen to 60,500. Since the war, betwen eighty and ninety thousand head a year have

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[41] *International Review of the Science and Practice of Agriculture,* 1916, p. 851.

[42] Harrell and Morgan, *loc. cit.*

[43] "Argentina, Its Agriculture and Livestock in 1910," *Anales de la Sociedad Rural Argentina,* p. 79.

gone to the *saladeros*.[44] The numbers used for meat extract have also been declining.[45]

There has been an important export of live cattle, chiefly butcher stock to the Argentine and breeding stock to Brazil.[46] This trade has decreased in this last decade. The total live exports were 115,450 head in the average year 1909 to 1913, since when they have been decreasing.[47] Recently a new export trade direct to Europe has sprung up, comparatively light animals being suited to the continental demand. In 1924 this latter trade took 41,000 head. There is also an important, though diminishing, trade in canned meats, including tongue and beef broth. The most important exports from the cattle industry are frozen and chilled beef. The following table taken from Weddell's *Review* shows the exports of refrigerated beef and mutton for the last six years.[48]

EXPORTS OF MEATS FROM URUGUAY

(*Long Tons*)

Year	Mutton and Lamb	Frozen Beef	Chilled Beef	Offal	Total
1920.....	3,764	98,462	2,943	4,810	109,979
1921.....	8,823	54,996	15,178	3,663	82,660
1922.....	8,751	32,755	39,787	3,865	85,158
1923.....	16,229	65,088	28,722	5,189	115,228
1924.....	16,214	89,144	30,203	5,920	141,481
1925.....	9,115	94,092	36,207	8,001	147,415

It is rather surprising that a country with so many sheep does not export more mutton and lamb. There is an export of live sheep, which was formerly very im-

[44] *Foreign Crops and Markets*, May 9, 1923, p. 323.

[45] *International Review of the Science and Practice of Agriculture*, 1916, p. 851.

[46] *Commerce international de bétail et de ses dérivés*, p. 78, and Harrell and Morgan, *op. cit.*

[47] See page 578, *infra*.

[48] Weddell and Company, *op. cit.*, 1924, pp. 17-18; 1925, p. 19.

portant.[49] In 1913, 106,623 head were exported, but from that year on, less than 30,000 a year were shipped and in 1921 only 6,658 were exported.[50] One reason for only a moderate export of mutton lies in the fact that many of the sheep belong to the wool-producing breeds. However, over half of the sheep are reported as belonging to the English mutton breeds.[51]

The domestic consumption of meat is not known to any great degree of exactness. In 1913 the number of sheep reported as slaughtered for the supply of the capital city, Montevideo, was 106,391 and for the rest of the nation 99,903. By the year 1921 these numbers had increased to 140,313 and 202,896 respectively. By 1925 they had decreased again to 111,600 and 73,705 head. The cattle slaughtered for the consumption of Montevideo in the average year 1909-1913 were 172,358 and for the rest of the country 132,282. In 1921, the slaughtering of cattle for these markets was respectively 191,938 and 125,483 head.[52] In 1925, 273,279 head were slaughtered for the Montevideo market and 175,026 head for the rest of the country. There also were 30,201 hogs and 10,800 suckling pigs slaughtered for the capital and 2,468 pigs for the country markets in 1925. In addition, probably 10 per cent of the cattle and 20 per cent of the sheep were slaughtered privately on the ranches.[53]

Paraguay

This comparatively small country is immediately to the northeast of Argentina and is entirely inland. Its area

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[49] J. B. Wilson in *Rivista del Ministerio de Industrias* (Uruguay), 1919, pp, 343-380.

[50] *Foreign Crops and Markets,* May 21, 1923, p. 299.

[51] Wilson, *loc. cit.*

[52] *Foreign Crops and Markets,* May 9, 1923, p. 323.

[53] Report of U. S. Commercial Attaché, L. B. Clark, Montevideo, April 20, 1926.

is approximately 170,000 square miles, which is about equal to that of the two leading provinces of the Argentine or a little larger than New England combined with the Middle Atlantic states in the United States. The eastern half is between the Paraguay and Parana rivers and is moderately hilly and wooded in parts. This partakes of the character of the southern Brazilian highlands. The western half lies between the former river and the Pilcomayo River and is an extension northward of the Gran Chaco of Argentina.

The eastern district has a relatively high average elevation, being fairly hilly. Some parts of the extreme southeastern corner of this are distinctly low and swampy, but the major portion is a part of the great Brazilian plateau which extends south as far as Uruguay. There are no high mountains, but there is a succession of wide grass-covered valleys and low timbered hills. Although the northern part is in the tropics, the temperature is not extreme. Frosts are rare and 106° F. seems to be the maximum temperature, a point frequently reached much farther from the equator. The average temperature, of course, is fairly high, being about 81° in summer and 71° in winter.

This part of the country is well suited to the raising of cattle and sheep, but only cattle are raised to any extent. The soil is good and the rainfall ample. Corn is grown and also some alfalfa.[54] The native pasture is unusually rich. Four acres to the beast is regarded as ample and it is claimed that in some parts 1.65 acres will feed an animal for a year and put it in marketable condition.[55] The cattle industry is most highly developed in the southern part of the country and in the extreme north. Through this district large estates are the rule. One ranch was said to have 100,000 cattle in 1915.[56]

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[54] Carel, "Paraguay and Its Possibilities as a Market," *The Americas*, March, 1915, pp. 13-19.

[55] *Second Pan-American Commercial Conference*, p. 188.

[56] *Bulletin of the Pan-American Union*, July, 1915, p. 133.

The half of the country west of the river Paraguay and extending to the foothills of the Andes is but poorly developed as yet. It was described a decade ago as containing "vast expanses of grazing land and immense forests, all awaiting exploitation." [57] Its eastern portion is now partially developed, but the west, whose ownership is in dispute with Bolivia, is still largely unexplored. Near the rivers the flatness of the country and the sluggishness of the current render the land subject to floods, which at times are serious. Farther from the rivers there is less water and wells must be dug. The elevation of this whole section, however, is so low that it has a subtropical climate. The United States Consul at Ascunsion has written of this region fairly recently as "a great level plain, swampy in some part, but in general consisting of fine pasture lands with sufficient water for the needs of grazing cattle, and interspersed with clumps of trees and small woods which in the northern part contain valuable hardwood timber." [58] The inhabitants are chiefly nomadic tribes of native Indians, and many of the native cattle roam wild on the plains. However, large cattle ranches have recently been developed in this region.[59]

The cattle of the whole country are still largely unimproved Criollos, although 20 per cent of the herds are somewhat improved with foreign blood, chiefly Herefords and Shorthorns imported through the Argentine. Zebu stock from India was at one time imported in the attempt to build up an improved cross immune to Texas fever and other diseases so prevalent in warm countries. This experiment has proved a disappointment.[60]

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[57] Carel, *loc. cit.*

[58] *Supplements to Commerce Reports,* U. S., "Paraguay," 1922, p. 9.

[59] *Ibid.*, 1923, p. 13. Harrell and Morgan, *The Livestock Industry of Uruguay and Paraguay,* U. S. Department of Agriculture, Bureau of Markets, Report on Foreign Markets, No. 41, 1920.

[60] *Encyclopedia of Latin America,* p. 731.

In 1915 it was estimated that there were 5,249,043 cattle and 600,000 sheep in the country. Estimates for 1923 gave approximately 4,000,000 head of cattle, and in 1925 the best available estimates showed 5,000,000 head.[61] There probably was a real decrease through unusually heavy killings during the war period.

There are several packing plants in the country which confine their efforts to the production of jerked and canned beef, beef extract and by-products. The seacoast is a long distance away by either boat or train, and with her low-grade stock and poor transportation facilities Paraguay cannot compete favorably as yet with other better developed and more favorably situated countries. During the war the market was not so exacting and used everything it could get. The recent general depression placed the country in a very unfortunate position. The chief export outlet for the cattle is in the form of jerked beef and fat. During the war the better class of cattle was shipped alive to Argentina.[62] The high point in this trade seems to have been reached in 1917 with 52,936 head.[63] Exports of fresh meats have not been developed as yet.

The following table shows the principal exports of animal products during recent years.

PRINCIPAL EXPORTS OF ANIMAL PRODUCTS FROM PARAGUAY[64]

Product	1921	1922	1923	1924
Cattle, live, number	6,614	52	48	6
Jerked beef, pounds	1,771,599	3,425,005	2,933,622	1,019,901
Fat, pounds	226,157	563,887	2,758,466	3,490,799
Hair and bristles, pounds	153,985	212,153	234,338	.....
Cattle hides, dry, number	51,739	95,034	75,215	67,352
Cattle hides, salted, number	139,154	204,485	252,463	270,970
Horns, pounds	113,305	514,984	509,457	224,810
Wool, pounds	7,414	51,563	45,329	118,407

[61] D. A. Wilson, *U. S. Consular Report* (Ascunsion), September, 1925.
[62] *Encyclopedia of Latin America, loc. cit.*
[63] *Commerce international du bétail et de ses dérivés*, p. 17.
[64] Wilson, *U. S. Consular Report*, March, 1925, and other sources.

The meat production of this country evidently has great possibilities of expansion when the world's markets expand sufficiently to make a serious bid for its output. Improvement of quality must largely await an increased market.

Brazil

Brazil has an area of 3,285,000 square miles, which is even larger than that of the United States. The equator passes through the country and nature is so prolific in many parts that man has not yet learned how to use the possibilities of the land. However, Brazil has no arid and semi-arid regions to compare with the less fertile lands in the United States. In this vast area the last census, which was taken in 1920, showed only 34,271,000 cattle, 16,169,000 swine, 7,933,000 sheep and 5,087,000 goats.[65]

The live-stock industry of Brazil is, on the whole, in the earliest stages of extensive development. Even in the most advanced sections in the south, stock-raising methods are chiefly those of the frontier region. Most of the animals are comparatively low grade, and the carcass yield is small even though they are slaughtered at a considerably more advanced age than is customary in countries where the industry is better organized. Brazil has, in fact, only begun to develop its enormous live-stock possibilities.

In such a vast country there are, of course, many varieties of climate and soil. The equator crosses the northern part of the Amazon Valley. Here is found the unusual combination of a great area of low-lying wet land and equatorial latitude which gives an extreme torrid climate. This extends as a belt across the country into the countries to the west. To the north there are plains of only moderate elevation within the national confines.

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[65] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 221-233.

South of this valley, however, there are great expanses of higher land. In fact, the greater part of the country is fairly high and the southwestern five-eighths is a vast plateau having an elevation of 1,000 to 3,000 feet above sea level. This plateau has a climate tempered by its elevation especially toward the south.

The parent stock of the herds of Brazilian cattle came from Portugal and does not differ much from that classed as Criollos in the Spanish parts of this continent. These animals supplied the earlier local meat demands and provided suitable carcasses for the production of jerked meat for the export trade and also for the internal trade of the country. They are fair meat producers, but small and far from being truly satisfactory for the industry, although they are hardy and stand the climate and diseases much better than the good stock of north Europe. In the attempt to improve the productivity of the cattle without weakening their disease-resisting qualities, a considerable number of Zebus have been imported from British India. This breed has had a far-reaching influence in the native herds.[66] It has produced a larger animal perfectly suitable for the production of jerked beef, but the meat is too coarse to satisfy the demands of the modern fresh beef trade, which has made a bid for Brazilian supplies only during the last decade.[67] Within recent years there has been a serious attempt, supported by the government, to improve the stock by the introduction of the best beef breeds of the western world and by the holding of livestock exhibitions.[68] This movement has not produced any

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[66] P. Moraes Barros, "A Crise da pecuaria," *Revista da Sociedade Rural Brasileira*, June, 1922, pp. 324-328.

[67] *Second Pan-American Commercial Conference*, 1919, p. 117; P. Moraes Barros, *loc. cit.*

[68] *Encyclopedia of Latin America*, p. 719; G. Lüthy, "Rapport sur la situation d'élevage dans l'Amérique du Sud, notamment au Brésil," *Annuaire agricole de la Suisse*, 1921, pp. 49-70.

great results as yet, excepting in the south. The chief difficulty lies in discovering which breeds are best suited to the three different climatic zones.[69]

The cattle of Brazil are chiefly grass fed. The common, but wasteful, method of developing pasture has been to burn over an area and scatter grass seed. In this way very large areas of pasture have been produced at very little expense. The grass-covered prairie of the inland states is quite inferior to that of Argentina, and alfalfa has not been established to any great extent. Large estates or ranches are, of course, still the rule. Corn is produced quite extensively and should eventually become the basis for an important pork export business. At present the production of corn is five times greater by weight than that of coffee and nearly as great in value, but it does not appear in the export trade.[70] Wheat is not grown in sufficient quantities for home use.

The distribution of stock within the country, as shown by the numbers found in each state in the census of 1920, appears in the table on page 470.

This table shows quite forcibly that the live-stock industry is not confined to any one zone or climatic condition. The states with over a million head of cattle are scattered from Rio Grande do Sul in the extreme south to Piauhy, which is between the parallels of latitude 3° and 10° south, and from Bahia and the east to the great inland state of Matto Grosso beside Bolivia. Rio Grande do Sul has decidedly the most sheep, but Bahia also has a large number and even Ceará on the northeast coast has a substantial number. The greatest number of swine are found in the states of Minas Geraes, Rio Grande do Sul, Sao Paulo, Bahia and Parana, all of which are on the southeast side.

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[69] *Journal of the Board of Agriculture* (England), 1922, p. 1294.
[70] H. G. James, *Brazil after a Century of Independence*, p. 293.

ANIMALS REPORTED IN CENSUS OF 1920 IN BRAZIL[71]

State	Cattle	Sheep	Goats	Swine
Alagoas	388,378	164,210	219,081	86,869
Amazonas	238,449	12,479	3,602	35,270
Bahia	2,698,106	954,617	1,419,761	784,155
Ceará	580,028	393,558	530,743	183,737
Espirito Santo	161,160	11,627	20,928	367,168
Federal District	23,367	2,398	4,685	22,639
Goyaz	3,020,769	41,574	36,311	485,390
Maranhao	834,596	48,016	120,692	171,683
Matto Grosso	2,831,667	40,242	9,374	108,448
Minas Geraes	7,333,104	310,938	203,102	4,870,549
Para	615,482	31,661	16,419	208,450
Parahyba	444,928	279,156	545,897	99,238
Parana	539,765	56,265	44,254	778,342
Pernambuco	745,217	419,872	855,638	226,181
Piauhy	1,044,734	207,517	301,353	208,398
Rio de Janeiro	581,203	33,130	41,580	512,882
Rio Grande do Norte	318,274	166,146	216,290	30,327
Rio Grande do Sul	8,489,496	4,485,546	94,413	3,367,098
Santa Catharina	614,202	48,825	16,576	613,833
Sao Paulo	2,441,989	96,885	252,711	2,934,153
Sergipe	311,239	123,708	132,294	51,855
Territory of Acre	15,178	5,067	951	21,879
TOTALS	34,271,324	7,933,437	5,086,655	16,168,549

The state of Rio Grande do Sul has the most temperate climate of any part of Brazil. It is within the temperate zone and not as far north as parts of Argentina. The natural conditions are all distinctly favorable to the livestock industry and it has the greatest number of cattle and sheep of all the states and is only second in the number of hogs. The improvement of stock has gone farther in this state than in any other part of the nation. The best beef breeds have been introduced and some of the best dairy breeds. The sheep and swine have also been improved by the introduction of European breeding stock.[72] Contact with the neighboring countries, Uruguay and Argentina, has helped to develop progressive methods in this state,

[71] James, *op. cit.*, pp. 329-333.
[72] *Ibid.*

but the establishment of modern packing plants giving an outlet for higher-class products than those demanded by the domestic market has supplied the necessary incentive to progress. Even this state, however, is as yet decidedly behind its neighbors to the south in the quality of its products. The following table showing the disposition of the slaughterings in two recent years gives a fair index of the relation to the market. These two years, of course, were ones of comparatively small foreign demand.

NUMBER OF CATTLE SLAUGHTERED IN RIO GRANDE DO SUL[73]

Purpose of Slaughtering	1921	1922
Jerked beef	506,046	615,384
Frozen beef	134,407	31,789
Local consumption	337,934	364,335
TOTAL	978,387	1,011,508

Sao Paulo is another great potential meat producer. It has two of the finest freezing plants in the country besides others of lesser importance. The unusual demands during war times were so great that the herds have been temporarily depleted. This may not be an unmixed evil, for there is great room for the building up of a better class of stock.[74] The following statistics on slaughterings give some idea of the importance of the industry in this state.

NUMBER OF ANIMALS SLAUGHTERED IN THE STATE OF SAO PAULO 1919-1923[75]

Year	Cattle	Swine	Sheep
1919	238,664	65,182	2,253
1920	208,303	76,927	2,598
1921	148,377	52,879	1,933
1922	164,775	50,735	1,882
1923	272,843	198,503	2,170

[73] *Commerce Reports*, April 23, 1923, p. 232.
[74] *Foreign Crops and Markets*, June 21, 1922, p. 312.

MEAT PRODUCTION IN THE STATE OF SAO PAULO, IN THOUSANDS OF POUNDS [75]

Year	Frozen	Chilled	Fresh	Preserved	Other
1919.....	76,607	10,162	28,696	5,420	.....
1920.....	69,642	14,109	11,967	329	23,097
1921.....	36,509	20,876	19,534	132	5,196
1922.....	40,503	33,261	.....	242	24,963

Minas Geraes is too deeply committed to the Zebu to become a first-class beef producer for some time.[76] Dairying has reached a fair development there, owing to its proximity to Rio de Janeiro. Stock bred in the interior states are also fattened on its pastures before slaughtering for the Rio markets.[77] This state also is the leading hog producer, having 36 per cent of the pigs in the whole country. The hog industry flourishes particularly on the smaller farms which have dairy cattle.[78]

North and west of these southern states the animals belong chiefly to the native stock, all more or less related and modified by crossbreeding. These have been influenced only to a small extent by imported breeding animals.[79] The cattle of the great western states of Matto Grosso and Goyaz run wild and receive almost no attention except branding when calves and driving to market when fully grown. The journey to market is made on foot and consumes two or three months. At the end of this time they are thin and have to be fed for a time on the pastures of the eastern states before slaughter.[80] Unfortunately, the natural grass of this region is either poor or destroyed by periodic burnings. The most popular way of establishing

[75] *Ibid.*, Dec. 10, 1924, p. 644.
[76] *Ibid.*, June 21, 1922, p. 312.
[77] Lüthy, *loc. cit.*
[78] *Commerce Reports*, July-September, 1918, p. 312.
[79] James, *loc. cit.*
[80] Lüthy, *loc. cit.*

new grass is a new burning after which new seed is sown. This, however, does not produce the best pasture and light plowing or disk-harrowing is necessary to produce the best results. Needless to say, but little of the land gets this attention.

The Amazon Valley has little domesticated live stock, as yet at least. Some authorities believe that the industry never will get a foothold in this torrid region. However, there are some cattle there and they are said to be increasing rapidly.[81] Disease, of course, is a great obstacle, but disease is prevalent all over Brazil. Probably the greatest obstacle to progress in the live stock or any other industry in this district is the difficulty which all civilized human beings find in living and working under such conditions.

The foreign meat trade of Brazil has attained real proportions since 1914 when the first shipment of frozen beef was made. Prior to that time the chief market outlet was in the form of jerked beef. This is used extensively all over the nation even in Rio de Janeiro, which consumed 31,150,000 pounds in 1916. There has been some real export of this product, but the major export from any state has been to other Brazilian states.[82] Since 1914 several packing plants have been established and frozen and chilled meats were exported heavily during the war. Recently this trade has recovered from the post-war slump and has exceeded even war proportions. The exports of frozen and chilled beef, frozen mutton and offal amounted to 63,835 long tons in 1924 as compared with 39,459 tons in 1923, 32,869 tons in 1922, 61,000 tons in 1921 and 63,600 tons in 1920. In 1925 these exports amounted to only 44,754 tons. The bulk of these exports find their way to the continental markets which require comparatively thin

[81] *Brazil-Ferro-carril,* Vol. XXV, No. 316, pp. 461-462.
[82] *Encyclopedia of Latin America,* p. 721.

meat.[83] The following table shows the annual exports of beef and lard for the decade ending in 1923.

Brazilian Exports of Beef and Lard[84]
1914-1923, in Pounds

Year	Beef Chilled and Frozen	Lard
1914	small	453,000
1915	18,770,000	180,000
1916	74,209,000	172,000
1917	146,500,000	22,502,000
1918	133,397,000	29,254,000
1919	113,831,000	44,140,000
1920	134,255,000	24,597,000
1921	129,689,000	11,458,000
1922	66,664,000	4,334,000
1923	169,377,000	31,931,000

The Guianas

British, Dutch and French Guiana lie together on the north coast of South America. Their natural conditions are quite similar and they are also alike in that the animal industry in none of them is sufficient to meet the local demands for meat, although all have natural possibilities for the development of such an industry.

Along the Atlantic there is a fringe of alluvial soil lying in many places below the level of the highest tides and generally flooded in the rainy seasons. This coastal belt varies in width from 10 to 40 miles and contains practically all the cultivated lands of these colonies and the larger part of the live stock. The interior of the country is largely tropical forest. However, in the back-country there are extensive savannahs which are suitable for cattle raising. The climate is tropical in all sections, but the continuous blowing of the trade winds saves the country from

[83] Weddell and Company, *Annual Review of the Frozen Meat Trade*, 1924, p. 18; 1925, p. 20.
[84] *Foreign Crops and Markets*, May 18, 1925, p. 598.

excessive heat. It is said that the maximum temperature in the shade is only 90° F., while the minimum of 70° F. even at night is very rare.[85]

There is very little live stock in either Dutch or French Guiana. The industry has a modest development in the British sections. Estimates for 1924 showed 113,315 cattle, 16,185 sheep, 9,792 goats, 12,889 pigs and 175 buffaloes in British Guiana. In the case of cattle these figures indicated a substantial increase over 1913.[86] Apparently most of these animals are on the coastal belt, and it is estimated that there are 30,000 to 40,000 cattle in the hinterland on the savannahs.[87] Live stock is said to thrive on both coast and savannah and there are 11,700 square miles of the latter in British Guiana alone.[88] The chief difficulty standing in the way of developing these plains has been transportation. Practically the only outlet has been into the Amazon Valley of Brazil and this affords but a poor market. Recently, funds have been provided to make a cattle track through the forests from the savannahs to the coast in British Guiana.[89] This is the first step in opening up this important potential producing area for economic development.

Venezuela

Venezuela has very great expanses of potential cattle country, but climate and other natural conditions have retarded development of the live-stock industry up to the present and promise to hamper it for many years to come. Eventually these natural obstacles should be brought under

[85] *Handbook of British Guiana*, p. 47.

[86] *International Yearbook of Agricultural Statistics*, 1924-25, pp. 200-216.

[87] Ainsworth-Davis, *Meat, Fish and Dairy Produce*, Resources of the Empire Series, Part II, p. 60.

[88] R. O. H. Spence, "United Empire," *Royal Colonial Institute Journal*, Vol. IX, No. 2, pp. 61-65, 1918.

[89] Pearse, *The World's Meat Future*, p. 211.

control. When that time comes, Venezuela will be one of the great cattle countries.

The chief cattle district of the country is the plains north of the Orinoco and its tributary, the Apure, and extending northward to the mountains which swing around to the northern coast from the Andes on the east. This plain, the Llanos as it is called, is about 600 miles long and 200 miles wide. Its average elevation is only 650 feet above sea level and it is very flat. As a consequence it is easily flooded. Its northern limit is only 10° north of the equator and, being low, it has a tropical climate. Like other tropical lands, there is a wet season and a dry season. In the wet season the flatness of the land subjects great areas to floods. At that time the portions most thoroughly flooded develop great quantities of water plants and even crocodiles thrive. The lands less flooded grow coarse grass. During the dry season much of the country is so thoroughly dried up that there is no water for the cattle. The higher reaches of this great river plain, even on the north of the Orinoco, are, of course, not subject to such great extremes of water and drouth, and in some sections the pastures are abundant during the whole year.[90] In the sections subject to the worst extremes the cattle have to migrate from high to low land and back again, eating the green growth as it appears with the rain and retreating to higher land away from the floods in the rainy season, while in the dry season they follow the retreating waters downwards, eating the vegetation before it dries up. One serious factor is that the natural vegetation is too coarse to make good cattle food even when green and is very poor when dry. The introduction of other grasses will do much to make the forage supply more nutritious as well as more continuous throughout the year. New grasses are being introduced to a certain extent and corn can be grown very

[90] *Encyclopedia of Latin America*, p. 733.

successfully to serve as a basis for feeding in the dry season. Wells can also be driven to serve as water supplies for the cattle in the dry season, for there is always water at a distance below the surface. Much will also have to be done to combat disease before the cattle industry is very prosperous.

South of the Orinoco the land is higher and free from flooding. Some of this is grazing land and a few cattle ranches have been established. However, this section has had but little development and most of the southern district as a whole is under forest.[91]

It is said that a century ago there were many cattle in the country, but that political disturbances reduced the numbers. Needless to say, estimates on the earlier cattle population must be taken with great caution. During recent times the herds have been slowly increasing and in 1920 it was estimated that there were 2,600,000 head. The cattle are practically all native Criollo stock based upon the Spanish animals imported many years ago. The inferiority of the stock and the alternation of drouth and flood make their growth slow. The maximum weight is about 1,100 pounds alive and the carcass weight is usually less than one half of this.[92]

Most of the meat goes into local consumption. It is said that the capital, Caracas, which has a population only one-tenth that of the capital of France consumes one half of the quantity of meat eaten in Paris.[93] There has been some export of live cattle to Cuba and other islands of the West Indies, and a fairly important export trade in live cattle and pickled beef has grown up with the neighboring British island of Trinidad. A packing plant was established some years ago. During the war it exported some

[91] *Venezuela: A Commercial and Industrial Handbook,* U. S. Department of Commerce, pp. 106-112.

[92] *Commerce Reports,* January-March, 1919, p. 301.

[93] Pearse, *The World's Meat Future* (2d ed.), p. 210.

frozen meat for the Allied armies, but it was shut down in 1920.

Venezuela's meat-producing resources are practically latent and may be expected to remain so for some time, although various writers claim that the plains can support 50,000,000 head of beef cattle.[94]

Colombia

The Republic of Colombia has an area of 440,846 square miles and contains much land classed as suitable for the grazing of cattle, subject, of course, to the usual difficulties in a country so near the equator.

The Andes form several chains of mountains across the western side of the country interspersed with valleys draining to the north through the Magdalena. Among the mountains are highland plateaus having a temperate climate suited to agriculture and animal industry.

To the north are great plains including the valleys of the lower Magdalena, the Sinu and the Atrato and a coastal plain 40 to 75 miles in width between the Caribbean Sea and the coastal hills. The rainfall here is moderate and the cattle-growing conditions have been likened to those of the old Indian Territory in the United States. Shortage of water causes some trouble, but this can readily be overcome by sinking wells.

The western side of the country has a tract called the Cauca Valley between the western cordillera and a coastal range that is said to offer good possibilities as a cattle country.

The most extensive areas available for pastures are the savannahs of the upper tributaries of the Orinoco beyond the Andes toward Venezuela. The northern departments of this territory are claimed to be excellent grazing lands. In reality little is known of this country. It appears to be

[94] *Venezuela, loc. cit.*

free from the excessive floods and drouths of the lower Orinoco, but it is inaccessible as yet and its possibilities are all for the future.

The native grasses are plentiful and fairly good and are available for the entire year. The coastal country and the upper Sinu Valley have artificial pastures and are fenced. The savannahs are all open grazing ground and under natural grass of various types which afford luxuriant pasture. No extra feeding is necessary and the pastures have a good carrying capacity.[95]

The herds had their origin in Spanish stock, but cattle were brought in later from North America and recently good breeding stock has been introduced from the United Kingdom.[96] Zebus have been tried but discarded. The present breeds are mongrels of the Criollo type and produce a small carcass.

In the past, live cattle have been exported to a certain extent. In the first years of the century, cattle were shipped to Cuba and a little later, while construction work was in process, to the canal zone in Panama. Some cattle have been exported to the United States. At the end of the war there was talk of establishing a packing house. Recently lack of a market has stood in the way of any development.[97]

The numbers of cattle in the country have been estimated at from three to seven million head and there are a few goats and hogs. It is impossible to obtain any accurate knowledge of the exact live-stock population. The potential capacity of the country to raise stock is also open to

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[95] U. S. Consular Report, *Cattle Raising in Colombia,* Dec. 20, 1920; Colombia Information Bureau, "Cattle Industry in Colombia and Its Possibilities," *Bulletin of the Pan-American Union,* February, 1915, pp. 194 *ff.*

[96] I. G. Torres, "Breve historia del Ganado Americano," in *Revista agricola,* Organo del Ministerio de Agricultura y Comercio, Vol. IV, No. 1, pp. 12-25 (1918).

[97] *Supplement to Commerce Reports,* No. 42a, "Colombia," pp. 4-5.

question. It is variously estimated at from seventy to two-hundred million head of cattle.[98]

Ecuador

The Republic of Ecuador is a small mountainous country north of Peru. The Andes extend through the land from north to south in a double series of peaks rising from a high plateau. West of the Andes is a lowland region with a coast range. On the east the Andes throw out long spurs toward the plains of the upper Amazon basin. Since the equator runs through this small country, the lowlands are hot. The highlands enjoy a more temperate climate.

The live-stock industry of this country has been developed only for local needs. There is no certainty as to the numbers of cattle, which are the principal live stock. Estimates based upon the production of hides show that there are approximately a million and a quarter of cattle. Most of these are the native Criollos, but some high-class breeding stock has been introduced within recent times. The entire meat production is consumed within the country. With the exception of a small district around Quito the agriculture is in a primitive stage. The government and the large landowners are endeavoring to secure some progress in the cattle industry, but little has been accomplished as yet.[99]

Peru

Peru occupies an area on the western side of South America estimated to amount to 532,000 square miles, or somewhat more than that of Bolivia. The country is entirely within the tropical zone, but the influence of the cold ocean current on the coast and the altitude of the

[98] J. M. Coronado, in *Second Pan-American Commercial Conference*, 1919, p. 142.

[99] *Supplement to Commerce Reports*, U. S. Department of Commerce, "Ecuador," 1918; *Encyclopedia of Latin America*, p. 726.

Andean highlands temper the climate in a considerable part of the country.

There are three different types of territory in Peru. The coastal strip extending the full length of the country, but only about sixty miles wide, is dry. The prevailing rain-bearing winds of this latitude are robbed of all their water in crossing the mountains and the ocean current which flows along the coast is cooler than the land and gives the neighboring slopes practically nothing but mists and a partial relief from the heat natural to this latitude. Vegetation in this strip of territory is practically dependent upon irrigation or natural watering by the streams, although there is a little herbage in places which supplies a precarious livelihood for a few animals. At least a million acres can be irrigated with comparatively little difficulty and much more can be cultivated ultimately.[100] When this is done there will be a better opportunity for live stock. The greater part of the white population of Peru lives in this coast zone.

East of the narrow coastal strip is the plateau and mountain region which also extends the full length of the country, but it is wide and broken up by different ranges. On the western edge where this region shades into the coastal strip there is some rain, and cereals and alfalfa are grown successfully without irrigation. Cattle and sheep are grazed in these foothills. The plateau region proper has a great elevation. Between 10,000 and 13,000 feet above sea level the country is usually well-watered and the combination between the great elevation and the tropical latitude supplies a temperate climate. Corn and alfalfa grow up to 11,500 feet above sea level.[101] The live-stock industry of this region is relatively important and grazing can be carried on successfully up to 13,000 feet or more.

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[100] *Second Pan-American Commercial Conference*, p. 20.
[101] E. C. Vivian, *Peru*, pp. 146, 147.

There are large ranches here and, in addition to cattle and sheep, the native llamas and alpacas are found in considerable numbers. The cattle, as a rule, are small and bony, being of the native Criollo stock. They are neither good milkers nor meat producers. The sheep flocks have recently been improved by the introduction of British breeds, although wool is as yet their most important product. Pigs are also raised to a certain extent in some of the valleys where they are fed on alfalfa and grain.[102]

East of the plateau region is the montaña, or river and forest zone. It descends gradually into the valley of the Amazon and its tributaries. This territory contains 65 per cent of the area of the whole country.[103] At present this section is mostly wooded and inhabited by uncivilized natives and wild animals. In its lower levels the climate undoubtedly is torrid, but the level descends fairly gradually from the plateau region which is from two to three miles above sea level. The rainfall is heavy all over the district, but the temperature in the higher portions is very moderate. Even at an altitude of only 2,700 feet the mean temperature is said to be 77° F.[104] These lands are less accessible by way of the better-known parts of Peru than through the Amazon River and are practically unexploited as yet, nor is there any prospect of an early development of their unquestioned resources.

Peru has great possibilities as a meat producer in the remote future. Colonel Stordy, the Director of the Peruvian Government Farm, states that one section alone lying between 12,000 and 14,000 feet above sea level could with proper organization support 60,000,000 sheep instead of the 6,000,000 estimated to be there now.[105] No great ex-

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[102] "Peruvian Products and Markets," *Peru To-day*, Vol. VI, pp. 97-101.

[103] Vivian, *op. cit.*, p. 3.

[104] G. R. Enock, *Peru*, p. 234.

[105] *Foreign Crops and Markets*, Feb. 11, 1925, p. 139.

pansion of the industry, however, can be expected at an early date. At present there is practically no foreign trade in meats and the export of live stock is very small.[106] The first census of live stock was taken in 1923 and revealed 1,292,607 cattle, 11,034,390 sheep, 73,866 goats and 428,805 swine.[107]

Bolivia

This large country, which is equal in area to the whole west-north-central division of the United States, lies in the center of South America within the tropics and without direct communication with the sea on any side. The southwestern section is in the Andes and is an elevated plateau broken up by the ranges of these mountains. Part of this is well-watered and its elevation gives it a temperate climate. The part near the north of Chile, however, is arid. The northern section of the country is in the valley of the Amazon and is a well-watered, wooded plain, the temperature depending upon the altitude. The eastern side of the Andes descends gradually in a series of terraces which drain into the river systems of both the Amazon and the Plata. The population is one half Indian, and neither agriculture nor animal industry has reached any high degree of development.

The latest available statistics indicate that there are 734,266 cattle, 1,449,114 sheep, 467,956 goats and 114,146 pigs,[108] but these data are for the year 1910 and are not very dependable. This is a very sparse animal population for a country of such a size. However, the interests of the nation, so far, are mainly in the mineral deposits, and the relative inaccessibility of the country stands in the way of any development of animal husbandry beyond that re-

[106] *Commerce international du bétail et de ses dérivés*, pp. 13, 16, 36.
[107] *Foreign Crops and Markets*, Sept. 19, 1923, p. 208.
[108] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 221-233.

quired to supply local needs. In parts the cattle are wild and together with the llamas, alpacas and vicunas supply the scattered population with meat.[109] There is no real development of the industry excepting on the central plateau where the supply of animals is sufficiently abundant to meet the requirements of the local population.[110] This is the only region which has any important local requirements. When other sections of the country become sufficiently inhabited to produce a real demand or are opened up to modern commerce, the stock industry can be greatly increased. The plateaus toward the east could readily produce much meat, but in the present state of the world's demand there is practically no production for foreign trade.[111] The possibilities of the lands on the Amazon plains and in the upper reaches of the Gran Chaco above Argentina and Paraguay are bound up with the question of the possibilities of the industry in lowland countries in the tropics. At present the world is not ready for such a development.

In the present stage of the country's development there are some cattle in these lands east of the high Andes. The animals are all the most degenerate of Criollo stock and disease is prevalent. In the upper reaches of the Amazon Valley between the Beni and Manore rivers in northern Bolivia there is a considerable number of cattle. The pasture here is good and there is plenty of water. One great difficulty is the periodical floods during which the cattle must retreat to "islands" of higher ground. This difficulty and others will disappear eventually with the advent of modern developments, when these can profitably be introduced. Here, as in the southeast, cattle raising is the

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[109] *Encyclopedia of Latin America*, p. 719.

[110] *Supplement to Commerce Reports*, U. S. Department of Commerce, 1922, p. 7.

[111] *Encyclopedia of Latin America, loc. cit.*

most profitable industry among those in existence. Much of this southeast country is in disputed ownership with Paraguay and is the northern extension of the Argentinian Gran Chaco. Even here there is much good pasture and some ranching already established. Some of the ranches are actually fenced. Practically the only possible outlet for cattle from this southeastern district is south to the Argentine, while the northeast depends largely on the less favorable outlet through Brazil.

There are several thousand animals exported each year. How many it is hard to determine, for there is an export duty and it would appear that smuggling would be easier than the collection of the duty. Some cattle are also imported and a material amount of canned and prepared meats, especially jerked beef, is imported regularly.[112]

Chile

The Republic of Chile is a narrow strip of land on the west side of the Andes in the lower part of South America. It stretches over 2,500 miles from north to south and has an average width of only 90 miles. Needless to say, such a country has a variety of climate from the tropical region in the north to the cold regions around the Straits of Magellan. Wind and ocean currents also play their tricks with the climate. The ocean currents modify the extremes of temperature, while the winds make the northern third practically a desert and the southern third unduly wet. The prevailing winds in the south blow from the Pacific on to the Andes and the rugged coast lands and islands beside them and give an overabundance of rain for agriculture. Here sheep are grazed to a considerable extent and cattle are bred in the valleys. In the central part of the

[112] *Bolivia: a Commercial and Industrial Handbook,* U. S. Department of Commerce (1921), pp. 144-149.

country there is a fertile valley about 600 miles long which is fairly well supplied with water and is a rich agricultural and grazing section. The density of cattle and sheep is greatest in this section. North of this the winds blow from the east and lose their moisture in the Andes before Chile is reached. This district is a desert which produces the material for rich fertility for other countries from its nitrate beds.

Neither agriculture nor animal industry is well developed as yet. The southern section is exploited only to a small extent and even the central valley is developed only in extensive fashion. The land capable of being used for agriculture is estimated to be 146,000 square miles, one half of which is covered with forests, one-eighth is properly pasture land and one-tenth land which requires irrigation before it can produce much. About one-fourth of Chile is classed as plains not requiring irrigation.[113] Cereals are grown and alfalfa has been introduced for the cattle industry.

The production of beef is insufficient for the domestic needs and thousands of live cattle are imported annually from Argentina.[114] The raising of sheep is chiefly a meat-producing industry. These animals are largely crosses from the British breeds. The variations in climate bring the lamb crop for the local market at different times of the year, thus producing a more regular supply.[115] In the south at Punta Arenas on the Straits of Magellan there are freezing works for the slaughtering of sheep and preparation of mutton and lamb for the export trade. Some of these animals originate in the neighboring parts of Patagonia in the Argentine and it is impossible to deter-

[113] *Encyclopedia of Latin America*, p. 308.

[114] *Commerce international du bétail et de ses dérivés*, p. 77.

[115] U. Prado, "Caracteristica de la explotacion del ovejuno en Chile," *Boletin de la Sociedad Nacional de Agricultura*, 1922, pp. 682-688.

mine what proportion of the small exports is the product of the pastures of Chile. Several of the packing plants in this district have been closed recently.[116]

The live-stock population of the country in 1923 included 1,995,538 cattle, 4,569,166 sheep, 525,106 goats and 263,330 pigs. These figures compared with earlier data indicate a gradual increase in cattle within recent years and a decrease in sheep. If the estimates for 1906 and 1908 are correct those years were the period of the maximum numbers of cattle and sheep.[117] The live stock of the country could be increased considerably, but other more favorably situated lands are likely to develop their stock more rapidly.

Falkland Islands

These islands, which are part of the British Empire, are situated about 300 miles east of the lower end of South America. They have a total area of 4,618 square miles, which is nearly the size of the state of Connecticut. They are largely given over to sheep raising, as there is plenty of good grazing land, part of which is improved pasture, and the climate is admirably suited to these animals. The sheep are kept primarily for their wool and belong to the best British breeds. There are no freezing works on the islands, but there is a canning factory and there is a rather important shipment of canned mutton to Great Britain. Cattle occupy a minor place and the sole cattle products exported are hides and tallow. Pork products are imported.

The following table shows that there has been but little change in the situation during the last decade.

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[116] *Supplement to Commerce Reports,* U. S. Department of Commerce, 1922, p. 17.

[117] Holmes, *Meat Situation in the United States,* U. S. Department of Agriculture, Report No. 109, p. 199.

LIVE-STOCK POPULATION [118]

Year	Cattle	Sheep	Pigs
1913	7,530	698,072	60
1921	7,674	667,677	24
1925	8,778	634,858	49

[118] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Part II, p. 61.

CHAPTER XII

THE CARIBBEAN COUNTRIES

Central America, Mexico and the West Indies resemble South America rather than English-speaking North America in the condition of the meat industries. For the most part the population is of Spanish and Negro blood, frequently mixed. The economic standards of living are not very high and political conditions tend to be unsettled. Moreover, the climate is everywhere subtropical. It is no wonder that the general tendency of this region, in spite of a lack of industrialization, is to import meat or live stock to supplement the local production which has been allowed to languish.

Panama

Panama is a narrow strip of land connecting South and Central America. It has many detached mountains, but no table-lands to relieve the tropical heat. With the exception of the sides of some of the mountains toward the Pacific, which are sheltered from the prevailing winds, there is abundant water.

The number of cattle is roughly estimated to be about 200,000 and the swine 30,000.[1] One-third of the cattle are in the Province of Chirigui, which is described as admirably adapted to cattle raising on account of its good soil and light, easily cleared forest growth interspersed with small areas of natural savannah. The climate, of

[1] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1034.

course, is tropical or subtropical, depending upon the elevation, but it is stated that there have been no epidemics of cattle diseases for many years. In the dry season there is a lack of water. Nevertheless, it is claimed that the cattle industry could be greatly expanded in this and other parts of the Republic until there are half a million head on the pastures. The supply of meat is not equal to the demand.[2]

Costa Rica

More than one half of this small country lies between 2,900 and 6,825 feet above sea level. This highland region, to which elevation gives a temperate climate, is covered with dense forests and has no agricultural development of any kind. Below the level of 2,900 feet, in the tropical region, there are some savannahs, and the climate is said to be healthful at more than 150 feet above the level of the ocean.

There are large tracts of land, subject to a practically nominal rental, which are available for grazing. No shelter is required and no artificial feed is provided. The livestock industry is successful when conducted on a large scale. The present stock of cattle is based upon the native breeds crossed with Holsteins, Guernseys or Shorthorns.[3] The numbers of cattle increased consistently until recently, amounting to 477,000 in 1922 and 404,000 in 1924. The number of pigs has also increased until very recent years, amounting to 114,000 in 1922, but declining to 76,000 in 1924.[4] There is no refrigerated packing plant in

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[2] F. Lindsay, "Cattle Raising in Chiriqui, Panama," *Bulletin of the Pan-American Union*, April, 1911, p. 643.

[3] *Encyclopedia of Latin America*, p. 725.

[4] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 1032; *International Yearbook of Agricultural Statistics*, 1924-25, p. 213.

the country, but some cattle are shipped alive to the Panama Canal Zone.[5]

Nicaragua

Nicaragua has a chain of volcanic mountains on the west coast and to the eastward a more or less broken plateau of moderate elevation, which is comparatively cool and well watered and possesses rich soil. This plateau is, as yet, largely undeveloped forest land, and the live stock of the country is found chiefly in the northwestern part of the country.

There is no real information as to the numbers of live stock now in the country. Estimates of the number of cattle are found in the same source varying from 500,000 to 1,200,000 head. It is claimed that the industry can readily be expanded.[6]

Honduras

Honduras is an irregular table-land of moderate elevation with the exception of the coasts, which are swampy and hot. The highlands are fairly cool and healthful.

There are nearly half a million cattle in the country and about 180,000 hogs.[7] The chief center of the cattle industry lies near the southern boundary separating this country from Nicaragua. The Pacific portion of this section has been noted for its cattle since the days of the Spanish *conquistadores*. Other sections of the country also have numerous herds. Unfortunately, the native Criollo stock has been but little improved as yet. The natural conditions are fairly good, both water and shade

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[5] *Encyclopedia of Latin America, loc. cit.*
[6] *Ibid.*, pp. 574, 729.
[7] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 1033.

being abundant. The guinea and Pará grass at times grows so high that it hides the animals grazing in it.[8]

During the years of reconstruction in Cuba, cattle were exported to that market. Recently exports have been made by rail and water to the neighboring countries in Central America.[9] Exports of live animals to the United States are prohibited on account of the cattle tick. There has been considerable talk of erecting a packing house, but the plans have failed to materialize, owing to lack of a sufficient supply of animals.[10] On the other hand, the limited market for the stock discourages further development of the industry.[11] It is considered that there is a possibility of a considerable development in the industry if the problem of marketing could be solved.

Salvador

Salvador is the smallest but most thickly settled of the Central American republics. It has a narrow coastal plain of rich alluvial soil, but the most important part of the country consists of a plateau about 2,000 feet above sea level which is more or less broken up by river valleys and volcanic peaks. The climate is more healthful even on the coast than most of the neighboring countries, owing to the fact that, being sheltered from the prevailing wet winds, it is less humid. The highland interior has an excellent climate.

Agriculture, in the narrowest sense, is more important than animal husbandry, being carried on chiefly by small proprietors. Coffee, sugar and rice are the leading crops. Cattle raising, other than to supply the local demands for

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[8] *Encyclopedia of Latin America*, p. 728.
[9] *Supplement to U. S. Commerce Reports*, "Honduras," 1917.
[10] *Commerce Reports*, June 8, 1917, p. 1173.
[11] *Ibid.*, January-March, 1919, p. 1103.

dairy products and meats, is neglected. Even the local demands for beef are not supplied by the domestic production, and slaughtering animals are imported from Honduras.[12] Hogs are more numerous than cattle, which is not at all surprising considering the type of agricultural development and the fact that it is possible to grow four crops of corn in a year. There are no official statistics of the numbers of animals since 1906. At that time there were reported to be 284,000 cattle, 423,000 hogs and 21,000 sheep.[13] The official estimates indicate that the numbers of live stock have increased somewhat since then.

Guatemala

Guatemala is composed chiefly of a broken highland region sloping to the east and containing many upland valleys and plateaus. Owing to the elevation, the climate is fairly temperate and living conditions could be made healthful.

Statistics for 1925 showed 564,085 cattle, 148,266 sheep and 92,020 hogs.[14] These figures indicate a considerable decline in sheep and hogs, but, of course, all such data for this part of the world are approximations. The cattle belong chiefly to the native Criollo strain which weigh on the average only about 850 pounds. Recently, however, good breeding animals have been imported to build up better herds for dairying and beef production.[15]

Cattle thrive in all sections and some animals are found wherever there is any farming. The western slopes, how-

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[12] *Encyclopedia of Latin America*, pp. 728, 732.

[13] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 1035.

[14] *International Yearbook of Agricultural Statistics*, 1925-26, pp. 221-233.

[15] *Encyclopedia of Latin America*, p. 727.

ever, are especially suited to the industry.[16] Cattle are driven there from other sections as well as Honduras to be fattened on the rich pastures.

Meat is abundant in Guatemala and being cheap, as indeed it is all over Central America, the per capita consumption is very high.[17]

British Honduras

British Honduras is a small country directly east of Guatemala. Back of the swampy lands of the Mosquito Coast the country resembles the eastern part of Guatemala and has large tracts of grazing land. However, the pastoral industry has not been developed and live cattle are imported from Honduras and beef and pork from other countries. In 1917 there were only 3,000 cattle and 5,050 pigs in the colony.[18]

Mexico

Mexico has large natural possibilities as a producer of live stock, but political difficulties have always stood in the way of real development.

Much of the area of this large country has a sufficient elevation to relieve it from the difficulties of a tropical climate. The coast lands, excepting in the north, are tropical, but the interior is a series of plateaus on which the climate is mild because of the elevation. These highlands are not well-watered in the north and north-central portions where there are continuations of the arid and semi-arid conditions of the southwestern part of the United States. The peninsula of Lower California and the

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[16] *Supplement to Commerce Reports,* U. S. Department of Commerce, 1923, p. 10.

[17] *Encyclopedia of Latin America, loc. cit.*

[18] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, Part II, p. 60.

northern part of the west coast of the mainland also are dry. Otherwise the west coast and the highland regions of the south and east have an ample water supply.

The semi-arid parts of the highlands in the states of Sonora and Chihuahua in the north have great expanses of open-range cattle country. Here the cattle industry has been conducted for a long time along lines comparable to those on the Texas range in the days of the early development of the American west. The larger ranches, however, have been broken up and the business is in the hands of smaller stockmen. Formerly this section was the source of important cattle exports to the United States and it still supplies cattle for the markets of Mexico City. The grass here remains green for the entire year on the higher land and well water is easily secured.

In some places in the north, especially in the northern part of Lower California, the dry lands should in time be irrigated fairly extensively and animal industry be established on alfalfa.[19]

In the southern part of the country there are more brush and forest, and animal industry is overshadowed in importance by other industries. Nevertheless, there are more cattle to the square mile there than in the open range country. Here the cattle are frequently put in the cornfields in the dry season after the harvest.[20] However, it is said that the Para grass of the southern Mexican states is always green, grows luxuriantly and is very nourishing.[21] In this southern section, particularly in the lower parts, disease and ticks prove a handicap to the industry.

Political disturbances and uncertainty of land tenure resulting from the attempts to break up the large estates

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[19] *Mexican West Coast and Lower California*, U. S. Department of Commerce, Special Agents Series, No. 220, p. 317.
[20] *Ibid.*, p. 207.
[21] *Encyclopedia of Latin America*, p. 483.

and give them to the peasants have worked havoc with the cattle industry. It is said that in some sections the industry has almost disappeared. In 1902, there were 5,142,000 cattle reported in the country and in 1921, there were only 2,304,000. On the other hand, the number of pigs has increased very materially. The number of pigs in 1902 was 616,000 and in 1921 was 1,913,000. The numbers of sheep and goats have decreased even more strikingly than the cattle. The sheep decreased from 3,424,000 to 293,000 and the goats from 4,206,000 to 1,254,000 in the same period of years.[22] These statistics would indicate that small farming operations were taking the place of extensive animal husbandry. However, in a country having so large undeveloped resources, there is no necessity for peasant farming to be developed at the expense of more extensive operations. Mexico is said to have 120,444,200 acres of pastoral lands. There is plenty of room for an expansion of both types of operations. Mexico could readily be an important exporter of meats, but she has been a heavy importer for years. Between 1906 and 1912, imports of meats and fats ranged from 25,000,000 to 33,000,000 pounds a year.[23] In those days an important number of live cattle were exported to the United States. Recently, while there have been some exports to the United States, the imports from there have equaled the exports and additional supplies have been brought in from Cuba and Central America.[24] The imports of meats and fats have also increased. In the first 11 months of 1924 nearly 40,000,000 pounds of fats alone were exported to Mexico from the United States.[25]

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[22] *Agriculture Yearbook,* U. S. Department of Agriculture, 1923, p. 1034.

[23] Holmes, *Meat Situation in the United States,* Bulletin 109, p. 182.

[24] *Commerce Reports,* U. S. Department of Commerce, Jan. 7, 1924, p. 46.

[25] *Ibid.,* Jan. 19, 1925, p. 134.

Cuba

At the close of the Spanish-American War Cuba found herself almost without live stock. Cattle were imported later in considerable numbers from South America, Mexico and the United States. By the year 1905 this movement had produced such results that the island was thought to be overstocked.[26] Since that time the increase in the number of live stock has kept pace with the growth of population, but imports persists of meats and of live cattle for meat as well as for breeding stock.[27]

The number of cattle in Cuba was 5,085,031 in 1923, a substantial increase over pre-war figures.[28] The center of the cattle industry is in the eastern end of the island where ranch land is not so fully taken up as in the rest of the country.[29] In all sections the raising of cattle could be increased still further by improvement of the pastures and the use of more feed. Alfalfa has been introduced successfully and the use of Parana and guinea grass seed also produces better pasture than the native grass.[30] All pastures need to be fenced to offset the danger of too close grazing in the dry season. Artificial water supply and auxiliary feed are also necessary for the best results in the dry period.[31] The growing of sugar cane has encroached on the pastures within recent years. To what extent this movement will go is difficult to say. The local agricultural authorities think that the live-stock industry would be as profitable, if properly conducted, as the growth

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[26] H. M. Wolcott, "Cattle Raising in Cuba," *Cuba Review*, January, 1917, p. 18.
[27] *Encyclopedia of Latin America*, p. 725.
[28] *International Yearbook of Agricultural Statistics*, 1924-25, p. 200.
[29] Wolcott, *loc. cit.*
[30] *Cuba Review*, September, 1917, p. 12.
[31] Wolcott, *loc. cit.*

of sugar cane when the price of sugar is low.[32] In some cases, attempts have been made to utilize the by-products of the sugar industry for feeding cattle.[33]

The published live-stock statistics fail to specify the number of swine. Pork production, however, is fairly important, although the native pig is a scrub.[34]

The city of Camaguay in the east is a focus of the cattle and meat trade. Cattle from the surrounding country are concentrated there and many are shipped alive to the Havana market. Numbers are also slaughtered for local use and the meat is shipped without refrigeration to the surrounding towns.[35] Havana has a refrigerating establishment for the storage of meat, but meat is handled in other parts of the island without any artificial cooling.

It is estimated that about two-sevenths of the total meat supply of 350,000,000 pounds of all kinds is imported in one form or another. Live cattle are imported mainly from other Latin American countries and both meats and fats are imported from the United States. Uruguay sends supplies of jerked meat.[36]

Island of Haiti

The Island of Haiti is mountainous with elevated plains scattered between the hills. With the exception of one desert plain the island possesses great natural fertility. The western part, which is most densely populated, forms the Republic of Haiti. The central portion and the east are included in the Dominican Republic.

In the Republic of Haiti the live-stock industry is neglected.

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[32] *Cuba Review*, April, 1917, p. 8.
[33] *Encyclopedia of Latin America*, p. 725.
[34] *Cuba Review*, September, 1917, p. 12.
[35] *Ibid.*, April, 1918, p. 20.
[36] *Foreign Crops and Markets*, Jan. 24, 1923, p. 56.

The Dominican Republic is said to contain 3,000,000 acres of land suitable for grazing. These lands are well watered with numerous streams and rivers, and good grasses grow luxuriantly. The cattle are left in the open during the entire year. As a rule they are owned by small farmers, but there are a very few large ranches. On the whole the cattle are healthy, but they are chiefly mongrels which give a very small carcass. Nevertheless, the meat supply is sufficient for local needs and cattle are exported to Porto Rico and also to the Republic of Haiti. Meat for local consumption comes from freshly slaughtered animals as there are no facilities for storage.[37] Statistics of the numbers of animals in 1924 show 700,720 cattle, 161,913 swine, and 418,660 goats.[38]

The British West Indies

These islands are not the scene of any particular development of the live-stock industries. In general they depend upon the outside world to a greater or less extent for their foods of animal origin.

In Jamaica there is a good supply of fresh meat for local consumption, but not for export, and cured meats are imported. The government is stimulating improvements in the live-stock industry and there has been a material increase in the number of cattle and goats in this last decade.[39] In 1922, the official estimate showed 141,000 cattle, 32,000 swine, 7,000 sheep and 30,000 goats.[40]

The Bahama Islands are allowing the animal industry to decline and meats are imported.

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[37] *Commerce Reports,* U. S. Department of Commerce, 1918, No. 147, p. 1151.

[38] *International Yearbook of Agricultural Statistics,* 1925-26, pp. 221-233.

[39] Ainsworth-Davis, *Meat, Fish and Dairy Produce,* Resources of the Empire Series, p. 56.

[40] *Agriculture Yearbook,* U. S. Department of Agriculture, p. 1033.

In the British Virgin Islands there is good pasture of guinea grass, and the cattle industry is fairly important considering the size of the territory and the small number of people. There is also a certain amount of stock raising in the other Leeward Islands.

The Windward Islands are better stocked than most of the other parts of the British West Indies. St. Vincent and Grenada produce enough fresh meat for local consumption and export some live stock. Some cured meats are imported.

The Barbadoes are paying some attention to the improvement of the live stock, but the local production of meats is insufficient to meet the demand.

Trinidad and Tobago have not developed their livestock possibilities. There is plenty of good grazing land, but local consumption depends largely upon imports. Live cattle and salted meat are imported from Venezuela. Lard is imported from other quarters.

The Bermuda Islands have a small number of cattle, goats and pigs, but the production of meat is insufficient to meet the local demand, and live cattle, fresh beef and cured meats are imported.[41]

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[41] Ainsworth-Davis, *op. cit.*, pp. 55-60.

CHAPTER XIII

BRITISH NORTH AMERICA

Canada

The Dominion of Canada is a great potential source of meat for international trade. While the production of meat has increased greatly during the last decade, the capacity of the meat-producing industries has not yet been even approached, and just before the war stirred up an unusual foreign demand, the supply was barely equal to the domestic needs. Since the war, an important export trade has developed in bacon, beef and store cattle for the British markets.

This country has the largest area of any nation in the world, if the loosely associated Soviet Union in both Europe and Asia is left out of consideration. Much of the Canadian area, unfortunately, is so far north that it will not be exploited for agriculture unless the pressure of the world's population increases very materially. Much of this northland is an unexplored wilderness, parts of which are unquestionably relatively barren. At present only a comparatively narrow territory on the southern border lying immediately to the north of the United States is settled, and, in the west, even part of this has hardly as yet passed beyond the frontier stage of development. The possibilities for extending its agriculture northward are the subject of keen debates. In the east there is practically no development north of the 49th parallel, which is the northern boundary of the western states. In the west the prov-

inces have been opened up to settlers approximately one half of the way up to their northern boundary which is the 60th parallel. What may be the developments in the northern half of these provinces and in the clay belt north of the mountainous districts of Ontario and Quebec is a question of the future. The Rocky Mountains on the west partially shut off the modifying influences of the mild ocean currents just as the mountains of the Scandinavian peninsula affect the climate of northeastern Europe. It should be borne in mind in this connection that the 60th parallel, which is the northern boundary of the prairie provinces, is the southern boundary of Finland and the latitude of Leningrad and Stockholm and that Finland is coming into importance as a dairy country and the province of Archangel was one of the sources of beef for the Petrograd market before the Russian revolution. It is a question in Canada to-day of pushing north of the 50th parallel in the east and the 55th in the west. The fact that the slope of the country in the western provinces is generally toward the north, giving a lower elevation as the latitude increases, will work in favor of northward expansion. This slope brings the coming of spring somewhat earlier in the north than the south of the prairie.[1] In the region of Hudson's Bay the Arctic climate extends well to the south.

THE DEVELOPMENT OF THE LIVE-STOCK INDUSTRY

Domesticated animals were introduced into Canada by the French at the beginning of the sixteenth century, but there seems to have been but little development of the live-stock industry until more animals were brought from France to Quebec and what is now Nova Scotia in the early part of the seventeenth century. The French were

[1] W. Griffin, *Canada the Country of the Twentieth Century*, p. 125.

traders and hunters rather than agricultural settlers and the live-stock industry found a new start at the end of the eighteenth century when, at the close of the Revolutionary War in the United States, those Americans who retained their loyalty to the crown migrated to Canada, taking stock with them when possible and in every case taking with them a zeal for developing the land and raising stock. At this time new beginnings were made in the Maritime Provinces, the Eastern Townships of Quebec south of the St. Lawrence and in Ontario. The real foundation, however, of the present flocks and herds in all the provinces, except possibly Quebec, lies in the breeding stock of high quality brought in from Great Britain. Cattle were introduced on the western prairie about 1823 and by the middle of the century were scattered with most of the forts of the Hudson's Bay Company, even low down on the Mackenzie River in the far north.[2] Cattle were introduced into British Columbia in the early forties, but the industry made but little headway until the gold excitement came in the sixties.[3]

Western Canada, like other prairie countries, initiated the development of its land with cattle and sheep ranches. Cattle have held the most prominent place, for Canada has never been prominent as a sheep country. All progress until 1879 was desultory. In that year the Dominion government introduced a herd of one thousand breeding cattle for the purpose of establishing a beef supply for the Indian population to take the place of the buffaloes which had nearly disappeared. The venture was sufficiently successful to serve as an example for private enterprise. The first railroad was put through in 1883 and

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[2] *Canada and Its Provinces,* Vol. VII, pp. 654-656; Vol. XVI, pp. 506, 513; Vol. XXII, pp. 530, 531.

[3] S. F. Tolmie, "The Beef Industry of British Columbia," in *Beef Raising in Canada,* Bulletin No. 13, Department of Agriculture, Canada, p. 84.

settlers followed. Large tracts of land were leased from the government for grazing and extensive ranches were established. In the beginning the cattle were herded on the open prairie, but by 1885 many of the larger holders started to fence their land. This helped to insure better breeding practices and the leading ranchers used pure-bred bulls of the best beef breeds almost exclusively. Naturally, the animals were excellent "store cattle" when they were shipped to Great Britain, although the journey was a severe trial. Toward the beginning of this century the standards of the industry fell somewhat and stockers were brought in from other regions, some being the Criollo cattle of northern Mexico. Fortunately, this custom soon disappeared and a new move was made toward high-grade stock. With the passing of the years more railways were built and more settlers came in to take up land for cultivation and grain growing. As a consequence, ranching has been pushed away from the sections better suited to true farming. There are still, however, over six million acres of ranch leased or owned outright, besides millions of acres of grazing land in the forest reserves, and the ranch industry may continue for some time in the drier and the rougher sections and in the north. In the Peace River district of northern Alberta it probably will be some time before grain growing is very extensive, and this is so far north that it escapes the aridity of the Great American Plains, while the Chinook winds that blow through the mountain passes from the Pacific make the natural forage available throughout the whole year. The amazing thing is that even with the extreme cold of the Canadian prairies the stock on both farms and ranches are frequently kept in the open air the entire year and, with proper feed, can thrive and put on fat in the dead of winter. In some parts, particularly of Alberta, it frequently is possible for the animals to pick up much forage all through the

winter, but the general practice is now to provide a supply of winter feed for times of scarcity. Prairie grass cut on land not grazed or cut over the previous season is frequently made into hay and stacked for feeding. Unthreshed grain is also fed to a certain extent and in some cases artificial grasses are grown for hay. Cattle for winter feeding are given some protection from the wind and provided with water and salt. In many cases grain is also fed. Under such conditions the animals make good gains in weight all through the winter.[4]

THE CATTLE INDUSTRY

Ranching, as such, while stabilized in some districts, is disappearing on much of the prairie, and the hazards of single-cropping of grain have proved so great that the farms are being supplied more and more with live stock. From 1908 onward there has been a general tendency for cattle to increase in Alberta and Saskatchewan. In Manitoba, where cattle ranching had never been important, there was a temporary decline in the number of cattle in the years 1912 to 1915. In 1918 there were about twice as many cattle other than milch cows in all three Prairie Provinces as there had been a decade before. For a time during the period of adjustment there apparently was a temporary decline, but the turning of ranches into farms eventually stimulated the cattle industry rather than discouraged it. The sheep also met with no permanent set-back from the change in conditions. In fact, the decade leading up to 1919 witnessed an important increase in sheep raising in Alberta and a still greater increase

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[4] J. G. Rutherford, *The Cattle Trade of Western Canada*, Special Report of the Department of Agriculture, Canada; J. B. Spencer, *Beef Raising in Canada*, Bulletin No. 13, Department of Agriculture, Canada, pp. 60-72; J. H. Grisdale, "The Development of Agriculture in Canada," *Canada Year Book*, 1921, pp. 202-210.

in Manitoba, while in Saskatchewan there was a moderate increase.[5]

Mixed farming is increasing in favor on the prairie. The production of grain alone is subject to too many hazards and fails to maintain good farming. As a consequence, the farmers are raising more stock and winter-feeding animals either raised on their own farms or purchased as feeders. In 1920 nearly 56,000 cattle were shipped from the stockyards to the farms of Alberta.[6] The rougher lands in the grain sections are also used to raise young stock. In the summer the animals are kept on the grass and in the winter are kept on feed either in barns or very frequently in open yards with shelter only from the wind.[7] Such methods produce cattle fit for the local markets and excellent feeders for the eastern farms or for export to the United States and Great Britain. Needless to say, their finish cannot equal that of steers fattened in the American Corn Belt or on the east coast of Scotland, but as feeders they are unexcelled. The tendency in western Canada has been to rough the cattle along until they are three or four years old at the time of marketing. The policy of making the animals ready for market at a younger age is now being stimulated by the Dominion officials.[8]

British Columbia is not an important source of any kind of live stock. There are many excellent grazing areas and some good meat is produced.[9] Fruit farming, lumbering and mining, however, take the leading places in the

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[5] McFall, *Livestock and Animal Products Statistics*, 1909-19, Internal Trade Division, Dominion Bureau of Statistics, pp. 14-18.

[6] *The Origin and Quality of Commercial Live Stock Marketed in Canada*, Report No. 3, p. 12.

[7] Spencer, *op. cit.*, pp. 72-83.

[8] R. S. Hamar, "The Cattle Industry of Canada," in *Cattle Breeding*, Proceedings of the Scottish Cattle Breeding Conference (1924), pp. 392-404.

[9] Tolmie, *op. cit.*

economic life of this province which does not produce nearly enough meat for its own needs.[10]

Beef production is more important in Ontario than in any of the Prairie Provinces. Many feeders are brought in each year from the west and the supply of locally bred stock is greater than the numbers shipped in from the provinces of the west.[11] Quebec takes a much smaller part in the industry and does not produce enough meat to supply her own needs.[12] Dairying is fairly well developed and most of the local cattle marketed in this province belong to the dairy type. Quebec might readily produce an important amount of meat, but the industry is relatively stagnant in that province. Over 50 per cent of the cattle, calves and hogs reaching the Quebec livestock yards come from eastern Ontario, and practically all the better grades of cattle come from that province. There were a number of counties in Quebec that did not ship a single animal during the year 1922 and a considerable number shipped less than one hundred. Only a few more than two thousand head of feeders a year are shipped from the stockyards to be fed on Quebec farms. Central Canada as a whole is in the settled farming stage, where it is settled at all; ranching as known in the west never has existed. Young cattle are raised quite extensively in many parts of Ontario and the proportion of good stock is fairly high. The animals are generally pushed ahead more rapidly than in the west and the progressive farmers market them as fat stock at 20 to 30 months of age. Many of the western animals which are brought in for feeding are older. Ontario is the real fattening center of the Dominion. The southern part of the province has a

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[10] McFall, *op. cit.*, 1923, pp. 36, 37, 62-65.

[11] *The Origin and Quality of Commercial Live Stock Marketed in Canada*, pp. 69-70.

[12] McFall, *op. cit.*, 1923, *loc. cit.*

much warmer climate than any other section of Canada. Corn is grown there very successfully, though not so extensively as in the Corn Belt of the United States. Much of the corn is converted into ensilage, and roots are also fed to a certain extent to provide succulent feed during the winter. Corn is not fed as grain so extensively as it is in the fattening districts of the United States. The smaller grains are grown more extensively, frequently mixed. Such mixed grains are a very popular feed. The milling offals from the flour mills are also an important feed. In Central Canada, while the temperature is higher in winter than on the prairie, the humidity is greater and the animals are almost always kept in barns during the cold weather. This, of course, gives an added expense but improves the results.[13]

The Maritime Provinces are not important producers of meat. New Brunswick and Prince Edward Island produce a surplus of mutton and lamb for shipment both as live animals and dressed meat, but with this exception the local meat production is not quite sufficient to supply the local consumption. Dairying is more important than beef production and the animals are as a rule a mixture of breeds and unsuited to good meat production. Many of the cattle go direct from the pasture without being really fattened. The animals that are fattened are usually at least three years old. There is no real feeder industry in this part of the world.[14]

THE SHEEP INDUSTRY

The numbers of sheep in Canada have increased but little for a generation. During the war high prices for wool

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[13] Spencer, *op. cit.*, pp. 43-50.
[14] *Ibid.*, pp. 51-52.

and lamb stimulated the industry temporarily until an increase of about 50 per cent appeared in the numbers of sheep. Successful coöperative marketing of the wool had some influence on this temporary expansion. By the year 1923 the increase had been largely lost. The Maritime Provinces have excellent natural conditions for the production of lambs in farm flocks and the quality of the meat is unsurpassed. There is no opportunity for large-scale methods like those employed on the western range, however, and the farmers have been discouraged by the ravages of dogs. Prince Edward Island and New Brunswick do produce a small surplus for export and shipment to central Canada. Nova Scotia ships no surplus, but maintains more sheep than these other two provinces combined. Quebec also has ample opportunity for the expansion of the sheep industry, particularly on her rougher lands, but the war-time expansion has been only partially maintained. Ontario had 868,526 out of the 2,755,556 sheep in the Dominion in 1925. This province is the center of the pure-bred sheep industry of the country and has been the source of much of the breeding stock of the other provinces. Early lambs are also produced near the cities for the higher-class retail trade. The bulk of the industry, however, is on the basis of the farm flock which receives relatively little care. In the Prairie Provinces, sheep ranching has received some attention, but this phase of the industry has largely passed except in the drier sections. In 1919, Manitoba had 167,170 head and Saskatchewan had 146,911. In 1925, the numbers in these provinces had fallen to 101,997 and 131,359 respectively. Alberta had 364,498 in 1919 and 236,804 in 1925. British Columbia has the fewest of all the provinces and the war boom had the least stimulating effect on the industry in that province. This province produces less than its own requirements of mutton and lamb in spite of ample op-

portunity to expand production.[15] The sheep industry of Canada is not particularly vigorous, but the war-time expansion shows that if world market conditions become favorable, production can very readily be greatly expanded.

PORK PRODUCTION

The swine industry of Canada is devoted primarily to the production of the bacon pig rather than the lard hog. Producing conditions as well as both domestic and foreign demand are united in stimulating this direction of the industry. Corn is grown to a considerable extent in southern Ontario, but in other sections of the country the small grains which tend to produce flesh rather than fat are grown more extensively. The Canadian taste in bacon follows that of the British rather than that of the people in Germany and the United States, although considerable quantities of the product of the latter country are imported. The available export market, moreover, calls for lean bacon and the pig growers have as their goal the production of Wiltshire sides for the British market which pays nearly the top price for Canadian bacon.[16]

Ontario is preëminently the producer of commercial pigs. In 1925 she shipped 1,488,567 to the stockyards and packers. Quebec's shipments were only 77,511 head in the same year and those of Manitoba, Saskatchewan and Alberta, 259,507 head, 342,613 head and 646,452 head respectively. These figures show a very striking increase over those of 1922 for the Prairie Provinces and an increase of nearly 50 per cent for Ontario, but a decrease for Quebec.

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[15] Dryden and Ritch, *The Sheep Industry of Canada, Great Britain and the United States,* Department of Agriculture (Canada, 1911); Spencer, *Sheep Husbandry in Canada,* Pamphlet No. 47, Department of Agriculture. McFall, *op. cit.,* 1923, p. 13; 1925, p. 11.

[16] Spencer, *Swine Husbandry in Canada.*

The output in the other provinces went chiefly into farm slaughter.[17]

Pork production is to a large extent associated with dairying in Canada, although it is also carried on occasionally on non-dairy farms. Cheese production is very important in central Canada and the resulting whey is used as the basis for one type of pig raising. Skim milk is also an important feed in the butter regions. Many pigs are raised on farms where there is little or no dairying. Roots in winter and forage in summer take the place of the dairy by-products. This form of the industry is becoming established in many parts of the west. It is common in Canada to feed considerable green roughage or run the pigs on pasture in the summer and to feed roots in the winter. Corn is used to a certain extent for fattening, but the use of other grains is much more important than in the countries which produce fat pork.[18]

Reference has already been made to the surplus and deficit of meat in the various provinces. The Canadian statistics are very complete in showing the origin and destination of all Canadian-produced meat and live stock that goes into interprovincial or foreign trade. No record, however, is available of the localities which afford the destination of the large quantities of imported meats. The statistics show clearly that surplus production is practically confined to Ontario and the Prairie Provinces. As already noted, New Brunswick and Prince Edward Island produce a surplus of sheep and lamb which go both to other provinces and to the export market. All of the provinces make some shipments of each kind of live stock even though the receipts may outnumber the shipments. All of them also ship some meat. New Bruns-

[17] *Origin and Quality of Commercial Live Stock Marketed in Canada in 1925*, pp. 7, 17, 28, 38, 47.
[18] Spencer, *loc. cit.*

wick ships no meat but mutton and lamb, and none of the Maritime Provinces, British Columbia nor Saskatchewan ships any large quantities of any kind of meats. Saskatchewan's surplus moves on the hoof.[19]

CONSUMPTION

The consumption of meat is increasing in Canada both in total amount with the growth of population and on account of an increase in the per capita demands. It has been estimated officially that the consumption of beef, pork, mutton and lamb in 1900 was 109 pounds per capita and in 1910 was 137 pounds. The estimate for 1920 is 114.21 pounds; for 1921, 155.89 pounds; for 1922, 156.75 pounds; for 1925, 161.2 pounds. Beef, with veal, amounts to 70.55 pounds in the estimates for 1923 and 74.91 pounds in 1925, and pork amounts to 81.52 pounds in the estimates for 1923 and 78.06 in 1925, while mutton and lamb together amount to only 8.23 pounds in the estimates for 1925. In addition, it is estimated that in 1925 there were 6.31 pounds of fowl; .64 pounds of turkey; .16 pounds of duck and .30 pounds of geese, totalling 7.41 pounds of all kinds of poultry consumed by the average person in the country.[20]

FOREIGN TRADE

Canada's foreign trade in live stock and meats has passed through extreme fluctuations in this past half century. Some of these fluctuations have come from changes in foreign demand and from outside trade restrictions; some from changes in the economic organization of Canadian life. In 1880, about 55,000 cattle were exported

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[19] McFall, *op. cit.*, 1923, *loc. cit.*
[20] *Ibid.*, pp. 66-68; 1925, pp. 60-62.

alive, largely to Great Britain. In 1885, the number increased to 143,000, but declined again. In the last century many Canadian cattle were bought by the British farmers to fatten as store cattle. The British embargo of 1896 against the entry of cattle for other purposes than immediate slaughter appears not to have discouraged the trade, for in 1900, 205,524 head were exported, more than half of which went to Great Britain. In the first decade of this century the exports varied from about 150,000 to 175,000 head. In 1911-13, the trade fell off seriously with cheaper South American meat flooding the British market and the demand increasing in Canada. In 1913, tariff restrictions were taken off by the United States and 219,729 head were exported in the following year, mostly to the latter country. Since then until the imposition of the postwar tariff restrictions of the United States the exports to that country have been heavy. In the year 1919-20, 518,352 head were exported, chiefly through the western stockyards to the United States. Since the imposition of the emergency tariff of 1921, shipments to the United States have been much smaller and the removal of the British embargo against the importation of store cattle from Canada at the end of 1922 has opened the way to the renewal of trade in that direction, which amounted to 110,868 head in the year 1925.[21]

The foreign trade in live hogs has never been important, but that in sheep formerly assumed substantial proportions. In 1870, 313,619 sheep were exported, mostly to the United States. In 1881, the number was 354,155, which included 80,222 for the United Kingdom. In 1901, 394,681 were exported, still largely to the United States. The low-water mark in this trade was the year 1912-13 with 13,760 head. War demands brought the number up to 134,705

[21] *Fifth Annual Live Stock Market and Meat Trade Review* (1924), Dominion of Canada, Department of Agriculture.

head in 1917-18 and 184,323 in 1919. In 1924, the trade had again fallen off and amounted to only 20,719 head, but it increased to 40,383 head in 1925.[22]

Beef exports have gone chiefly to the British market. Beef and mutton together to the amount of 1,816,200 pounds went to the United Kingdom in 1871, and 2,027,700 pounds went to the United States the same year. Meat exports declined drastically after that but were revived in the nineties. In 1901, 9,710,458 pounds of beef were exported, most of which went to the British market. The mutton and lamb trade had virtually disappeared. In a few years after 1900 the beef exports practically disappeared and their place was taken by net imports for a time. In 1913, the export trade appeared again and war demands stimulated it to nearly 130 million pounds in the year 1918-19. Thereafter the trade declined again and averaged about 25 million pounds a year until 1925 when it amounted to 34,627,700 pounds. The foreign trade in mutton and lamb had been on the net import basis every year but two in this century until after the end of the war. There have been some exports, mainly to the United States, but imports of New Zealand lamb have surpassed the exports until recently when the trade has swung outward again.[23]

Pork products were exported in considerable quantity in the latter part of the last century. The trade reached its peak just at the beginning of this century, the years 1900 and 1903 being the banner years with 136 and 146 million pounds respectively. From 1903 to 1913, this trade declined almost continuously until it virtually disappeared. At the beginning of the war it was revived very promptly, rising at once to over 100 million pounds. In the year

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[22] *Sixth Annual Live Stock and Meat Trade Review* (1925).
[23] *Live Stock and Animal Products Statistics,* Series.

1916-17, over 227,000,000 pounds were exported and 96,000,000 pounds imported, the latter partially at least for reshipment to Great Britain. The year 1919-20 witnessed the record shipment of 237,946,700 pounds and imports of 71,887,878 pounds. Since then the exports, largely to the United Kingdom, have been maintained well above 100 million pounds, but a considerable portion of the amount was offset by imports from the United States until the year 1925, when the imports declined and the exports amounted to 132,522,000 pounds of bacon and ham and 17,286,400 pounds of pork.[24]

The falling off in the export trade in the decade before the war was evident in dairy and poultry products as well as in meat. The cause was chiefly the change in Canada's domestic expansion. That decade witnessed a great increase of the railway mileage, particularly in the west, followed by an enormous increase in grain production. The frontier of cultivation was being pushed outwards very rapidly. The emphasis was temporarily diverted from mixed farming to grain ranching. The production of animal products lagged behind the domestic demand and Canada was a net importing nation in the case of several of these foods. The tide turned during the war. Mixed farming was restored and the numbers of live stock increased. The response of meat exports to the foreign demand in spite of the shortage of man power was very striking. It showed something of the latent producing capacity of the country. Fortunately, the stock was pushed ahead on to the export market and the market collapse of 1920 saw the live-stock industry partially liquidated. The postwar depression has had serious effects nevertheless. It has been coupled with the introduction

[24] *Live Stock and Animal Products Statistics,* Series; and *Sixth Annual Live Stock and Meat Trade Review* (1925), p. 46.

of a high tariff on feeder cattle entering the United States which, economically speaking, is the natural market for much of the western surplus. Facilities were lacking to fatten all the animals at home and the British feeder market was only opened at the end of the year 1922 and at best involves such expensive transportation that none but good-quality stock can be moved.

During the last few years the Canadian live-stock industry has shown a very notable advance. The foreign trade statistics show very real increases in the numbers of cattle and in the amount of beef and pork products exported. Over 100,000 cattle were exported to Great Britain in the 11 months ending with February, 1926. At the same time the exports to the United States amounted to 94,731 head. The total exports of beef amounted to over 31 million pounds and those of bacon and ham to 115,800,000 pounds in the same period.[25] Trade reports also indicate that the quality of cattle exported to the United Kingdom is of a superior grade.

THE FUTURE OF CANADA'S LIVE-STOCK INDUSTRY

The future of Canada's live-stock industry is a question of markets. Her climate is not as favorable as that of some of her competitors, although the British have recognized that her cattle are remarkably free from disease.[26] Her geographical relation to the world's best potential markets is excellent, but, temporarily at least, tariff restrictions imposed to help the western cattle breeders in the United States have partially closed that market. Organization of the cattle industry to serve the British market exclusively is difficult and seems unwarranted in

[25] *Monthly Report of the Trade of Canada,* February, 1926.
[26] *Report of the Royal Commission on the Importation of Store Cattle* (United Kingdom, 1921), Cd. 1139.

view of the probable future situation in the United States. The uncertainties of the tariff situation with the latter country present the greatest handicap for expansion of the cattle industry. The pig industry is definitely committed to the British bacon market for reasons that are sufficiently obvious. The sheep industry does not expand particularly in point of numbers, but has not declined as in many countries. The war years showed that demand alone is necessary to revive this industry.

Canada, in the part now subdued to the plow, has ample opportunity for large expansion of her meat industry, particularly if close relations could be guaranteed with the fattening facilities of the Corn Belt of the United States. All that is needed to expand the output is to increase the demand. North of the districts now used are very large areas that are useless under the conditions imposed by the present limited market demand. These regions may not be suited to the finishing of stock, but they can produce large numbers of feeders to be fattened farther south. The Dominion Live Stock Commissioner speaks thus about the northwest:[27]

> Away to the north, in all three provinces, lies the "Park Belt." This is purely a stockman's country. Grass and the wild vetch and pea vine grow luxuriantly. There is good shelter and easy access to plenty of water. Hay and fodder can be grown and put up for winter feeding. The soil is deep and fertile, and yields an abundance of rough feed. Rainfall is dependable. Given proper facilities with a stable market, this area alone will raise as much live stock as is now produced in all Canada."

Caribou and musk oxen have roamed the northern plains for ages and flourish up to the Arctic Ocean. In some sections it is said there are millions of caribou still in

[27] H. S. Arkell, "The Future of the Live Stock Industry," in *Canada's Future*, by E. A. Victor, p. 89.

existence. The reindeer of the Laplanders are domesticated caribou and some partially successful attempts have been made to establish these animals in northern Canada. Musk oxen might also be domesticated.[28] Attempts are being made to establish new breeds of cattle by crossing beef breeds with buffaloes and yaks. The results so far are fairly encouraging.[29] For a time such work will find its interest mainly for science rather than practical animal husbandry. The time may come, however, when Canada will find it advantageous to utilize part of her north for meat production and this scientific work will then yield practical results.

Newfoundland

The island of Newfoundland itself is over forty thousand square miles in extent, and the east coast of the mainland extending northward from the island to Hudson Strait, which is Labrador, is politically a part of the colony. The latitude of these two sections is about the same as that of the British Isles, but frigid ocean currents from the north keep the climate cold. There is no particular development of the live-stock industry, the main industries being fishing, lumbering and mining. In 1921, there were 27,789 cattle, 86,145 sheep and 14,110 swine in the country, and the slaughterings for consumption amounted to 7,690 cattle, 27,463 sheep and lambs and 9,658 pigs. The production of meat does not equal the domestic demand and there are considerable imports.[30] Dr. Grenfell feels certain, after experimentation, that

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[28] *Report of the Royal Commission Appointed to Investigate the Possibilities of the Reindeer and Musk Ox Industries in the Arctic and Sub-Arctic Regions of Canada*, 1922.

[29] Hamar, "The Canadian Bison-Cattle Cross," in *Cattle Breeding*, Proceedings of the Scottish Cattle Breeding Conference (1924), pp. 288-298.

[30] Ainsworth-Davis, *op. cit.*, pp. 52-54.

reindeer can be successfully established in northern Newfoundland and Labrador. No particular progress, however, has been made in that direction as yet.[31]

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[31] *Report of the Canadian Royal Commission on Reindeer, etc.* (1922), Appendix No. V.

PART III

MARKETING

CHAPTER XIV

MARKETING PROBLEMS AND AGENCIES

THE importance of marketing varies with the degree of social organization. The more civilized communities and nations alone have developed comprehensive marketing systems.

Throughout much of Asia and Africa the primitive communities have developed practically no function worthy of the name of marketing. When Abraham wanted meat he killed a kid himself or had one of his servants perform the operation for him and the carcass of the animal was forthwith cooked and eaten. No elaboration of this custom in the primitive communities has been introduced since his day.

In the farming communities of the most civilized countries such simple substitutes for marketing are not wholly unknown, but, aside from the preparation of fowl, somewhat more elaborate methods are common. Farm slaughter, as a rule, provides not only meat for immediate consumption but also sets aside part of the product to be cured or frozen for future use. It is not customary, however, in these days, for farmers in civilized lands to provide all their meat requirements from home-slaughtered animals. A large part of the farm-consumed meat comes from animals whose flesh has been prepared and distributed by the regular commercial agencies.

In the more highly organized communities, and especially in towns and cities, consumers are not also meat producers and the function of real marketing appears. Be-

fore the days of modern transportation most of the foodstuffs were usually grown near where they were eaten. To a varying degree, meats as well as other foods, are still the products of farms near to the final consumers. In such cases the marketing functions are relatively simple and little commercial machinery is involved; a butcher who buys the animals from the farmers, slaughters them and sells the meat to the householders, is the whole marketing system.

As the cities get larger, as the social organization grows more complex and the geographical specialization of industry becomes more complete, the marketing system must develop more elaborate form. The provisioning of a city or a specialized industrial section or nation involves many things that are unknown in simpler communities. The growth of large industrial communities increases the population more rapidly than the local production of meat animals, and the transportation of meat or live stock from distant places, with many attendant services, becomes necessary. Modern communities have also learned to demand services and assurances in connection with their food supply that are distinctly modern innovations. Meat must now be available at all seasons of the year, fresh or prepared as the consumers' taste rather than the convenience of the producers and market men dictates. This situation necessitates a certain amount of storage of meat from one season to another and the provision of supplies from different places which prepare their animals for market at different times of the year. It also requires very careful inspection of the animals and of the meat to assure wholesome food supplies and grading of the meat to provide each consumer according to his taste. A very elaborate marketing system is required to bring together the demands of the consumers in the leading nations and the production of live stock in all the commercial countries.

Since there is such variation in marketing methods in the nations of the earth, or even in one large nation, it will be impossible to present more than the chief outstanding marketing problems and something of the agencies and methods with which these problems are met.

CONDITIONS WHICH THE MARKETING SERVICE MEETS

The fundamental problem of marketing is to supply the demands of the consumers as cheaply and efficiently as possible from the output provided by the producers. Marketing of meat is complicated by the fact that the form of the product must be completely changed after it leaves the live-stock producers before it is usable by the consumers. The marketing process includes a manufacturing process. The product is also highly perishable, and the various parts of the carcass possess entirely different values.

The demands of consumers are greatly varied and subject to considerable fluctuation. This fact and the perishability of meat make the problem of its marketing very complex. There is an advantage in the differences in the demands of consumers, for there is also a great variety of meats to be sold. However, the fitting of the varied products into the varied demands, when each has its own peculiar variation of quality and seasonality of maximum production, is no mean task.

In discussing the demands in each nation the very great range in per capita consumption in different nations has been noted. To a certain extent this differentiation in consumption is due to limitations in the local production of meat. Modern methods of distribution and the production of industrial goods to be bartered for the meat supplies of other regions have, however, done much to make many regions less dependent upon local supplies. As a

consequence, demand has lost its dependence upon local supplies in many places. Differences in taste and differences in purchasing ability now determine the consumption in the leading centers of present-day civilization. What determines these differences in taste is a difficult problem. It is not strange that the Scandinavian should demand fat pork in his cold climate. The Englishman may also like lean pork because that quality is more easily produced in his cool climate and he has grown to like what has been supplied him. But why should the Englishman want his beef fat and all Continentals be satisfied with lean beef and most of them prefer fat pork and demand much clear fat in lard and edible tallow? Why also does the Englishman demand so much more mutton and lamb than his neighbors?

Differences in consuming habits are not all set off by national boundaries. There are very great differences between sections of any one country. Some of these are due to religious reasons. Pork and hind quarters of beef do not meet with a ready sale in Jewish sections. Cities which have a large Jewish population must be supplied with live cattle to be slaughtered locally for the kosher trade. This is usually heavy beef, and the hind quarters must be sold to the Gentiles. Most of the differences in consumption, however, appear to have an economic basis somewhat mixed with social customs. In a nation such as the United States, which has many social strata of many racial origins, there is great variation in demand within narrow geographical sections. The population groups with the largest incomes demand the most meat and the better grades, especially of beef and lamb. There also are considerable variations in demand that come regularly with the change of the seasons. Changes also come with the rise and fall of popular prosperity. There is a tendency not only to consume more meat, but more of the better

grades and beef in place of pork when the purchasing ability of the masses is at the best. There are also swings in demand from one type of meat to another equally as good. The demand swings from ham to bacon and back again for no clearly defined reasons.[1] The change of demand from heavier to lighter cuts of meat seems to be very general in the leading countries. The present tendency seems also to be toward the consumption of more meat in general whenever the purchasing ability of the masses is great enough to permit.

Scientific marketing may not require an answer as to why these consuming habits have arisen, but it does require an exact answer as to what the exact differences in requirements are in each quarter and how they vary from time to time. The marketing system must know what kind and quality of meat are wanted in a place, before any is moved there, for meat is too perishable and its transportation too costly for it to be shipped about from place to place seeking a buyer. It also must be supplied at the rate at which it is wanted or expensive loss will result. Successful marketing must go a step further and induce the raisers of live stock, as well as those who prepare the products, to produce the kinds and qualities of meat for which there is the most effective demand and to produce them in about the quantity and as nearly as possible at the rate which will fit the consumers' demands. In short, a successful marketing system does not stop with moving the products which happen to be produced to the people who are willing to pay the most for them. It studies the existing and potential demand and gets the producer as far as possible to produce what is wanted, thereby fit-

[1] G. W. Tasker, *A Survey of the Consumer Demand for Meat in the City of Boston, Mass.*, and Ludwig, Naughton, Southgate and Warren, *The Distribution of Meat in Metropolitan Boston;* studies conducted under the direction of the author on file with the New England Council of Research on Marketing and the Food Supply.

ting production to the demand. Even this is not enough in the meat business, for no animal can be grown which consists wholly of the kind of meat in greatest demand. The marketing system must, therefore, either find a demand or create one for the less desirable products.

The marketing system is confronted not only with irregularities and peculiarities which it must meet in the demand; it also is confronted with many difficulties on the side of production. The output of animals from the farms in any section of the world is usually highly seasonal, being influenced by the summer growth of grass and the fall ripening of grain as well as other factors in the farm economy which change with the seasons. The animals offered for sale are also frequently far different from what the market really wants. The original Danish hogs were not suited to the demands of the British trade and, since this was the only market open, the Danish coöperative marketing system changed the type of animal to one which produces the class of meat in the highest demand.[2] Frequently the farmers are not so ready to change their production, and a type of product continues to come forward that is undesirable. Geographical specialization of production is another very important factor in shaping the marketing systems. Our marketing systems now work so smoothly that they turn many of these difficulties into advantages, turning the seasonal output from many different regions into a continuous stream of products and seeking everywhere for the particular type of product each consuming market demands.

FITTING PRODUCTION TO CONSUMPTION

The presence of a middleman, or even a whole series of intermediaries between producer and consumers, renders

[2] H. Faber, *Coöperation in Danish Agriculture,* pp. 55-70.

the modification of both production and consumption no easy task. If conditions were so simple that the eater and the grower could come together and indulge in mutual discussions of their common problems, these things could fairly readily be adjusted. The middleman, however, has proved himself essential and the ideas must be transferred through him just as truly as he must transfer the products. Unfortunately, both producers and consumers have considerable distrust of the middleman and have a tendency to feel that his advice to modify production or consumption habits is for his own selfish profit alone. When the trade attempts to push a greater sale of fore-quarter beef, the public feels that the advice is prompted only by a desire to raise the price on these cheaper cuts for the purpose of increasing trade profits. In like manner the producer is loath to believe the advice handed to him by the man who buys his stock and has a tendency to believe himself cheated when he gets a low price for stock of poor quality. The suggestions that are handed back and forth between producer and consumer through the medium of the middleman in the marketing process do not carry conviction as readily as they would if the distrust of the middleman could be eliminated. At present the arguments are pushed home through the medium of price, which is a fairly convincing argument, but price alone fails to carry conviction of its reasonableness and does not show clearly what changes could with advantage be made in production.

Within recent years campaigns have been carried on by the trade associations to educate the producer to produce more nearly what the market wants and to convince the housewife of the reasonableness of using the types of meat in least demand. Public agencies are also taking a hand in this type of constructive work. The work of various governmental agencies in establishing standard

grades for live stock and meats is very valuable. It will do much to give a better understanding between all the parties to marketing transactions and must eventually help to bring conviction to the producers of poor-quality stock that they are actually at fault and that, when they get low prices, they are not merely the victims of a heartless system.

Modification of production and consumption to suit each other has its limitations. The market system must fit these two together to a large extent just as they stand. To fit a complex production to a complex demand the first and greatest necessity is information regarding the whole situation. With complete information of conditions, the market problem is half solved. No attempt to perform the physical tasks of market distribution on the hit-or-miss basis without knowledge of the main facts involved gives an efficient market service. Private agencies have in the past gathered much of the requisite market information for their own use. Without a large degree of coöperation between marketing agencies no private system of market information can be truly successful. A truly successful system of market information that will insure the closest harmony between demand and supply must draw its data from all interested agencies and publish it to all. It is difficult, although not impossible, to establish such a system on a private basis. As a rule to-day, public agencies are supplying at least a part of such a service. The United States government supplies a very elaborate system of information. Canada, with simpler conditions, has less extensive, but in some ways more comprehensive official data. Many of the older countries are not so advanced in this work and Great Britain does not yet have even public data on stocks of meat in cold storage.[3] The

[3] *First Report of the Royal Commission on Food Prices* (1925), Vol. I, p. 109.

presence of comprehensive and dependable market information makes the marketing processes simpler, cheaper and more serviceable. It also makes trade combinations less necessary.

INSPECTION

Another marketing service now almost universally provided by public agencies in the up-to-date countries is that of inspection of the animals and meat to insure that none but wholesome supplies are sold to the public. Since it has been fully realized that animal diseases may be communicated to human beings through meat or milk, public inspection services have been established to examine all animals just before slaughter and to inspect the vital organs and the flesh while the carcass is being dressed. This inspection service is a national proposition in such countries as the United States and Canada for all meat destined for export or trade between the sections of the country. Most of the leading export nations supply a satisfactory inspection service for the export trade in shipping to England and other leading importing nations. Strictly local trade in the smaller towns and villages is subject to local inspection in the most enlightened countries, but in hardly any case is such local inspection as satisfactory as the best national services. It is very common for farm-killed animals to be subject to no inspection whatever, even though the meat from these animals is shipped to town.[4]

The marketing processes involve the trade in live animals, the slaughtering of these and the preparation of the meat for final sale and the distribution and sale of the meats to the final consumer.

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[4] Bergman, *A Review of the Frozen and Chilled Oceanic Meat Industry* (1916); *Report on an Enquiry into a Uniform System and Standard of Meat Inspection in Scotland* (Edinburgh), 1921.

MARKETING IN EUROPE

In continental Europe most of this marketing has been on a local basis, the meat sold in any community coming from animals raised on near-by farms. The marketing of imported meats has until recently been of comparatively minor importance. Meat for use in the country regions and small towns frequently passes through the hands of but one middleman, the local butcher. The supplies for the larger towns and cities go through more intricate channels. Country buyers buy the animals at the farms or at the district fairs or markets which are held frequently. These country buyers usually ship the animals by rail to the larger towns and cities where they are sold at the central markets by commission merchants to the wholesale butchers. Slaughtering is generally conducted in abattoirs owned and managed by the municipal authorities, but the actual slaughtering is done by private agencies and many of the by-products fail of being put to the highest use. Facilities for cooling the carcasses artificially are usually absent or at best deficient and the meat goes forward for immediate consumption. Wholesalers or jobbers, who frequently cut up the carcasses, purchase most of the meat from the slaughterers. A considerable amount of the meat is exposed for sale by these wholesalers at central market places where the retailers come to buy. Some retailing is also done at the central markets, but most of the retailing is carried on in small shops and on pushcarts. Very little meat is shipped to other cities. Imported meats are being shipped since the war to the interior cities in refrigerated cars. There they go through the usual channels of trade.[5]

Coöperative associations of the farmers have taken over

[5] R. F. R. Martin, *Meat Marketing in France*, Report to Bureau of Agricultural Economics, U. S. Department of Agriculture.

many of these marketing functions in some of the countries. In Germany the country end of the business is handled by such associations to a considerable extent. These associations have their agencies in the live-stock markets where they sell the live animals to the regular trade.[6] In Spain the coöperators handle meat up to the sale to the retailers. In Denmark the coöperative associations handle most of the business of marketing pork, including curing and export and own their own slaughterhouses. In many cases consumers' coöperative societies begin at the retailing end of the market system and supply more or less of the earlier marketing functions.[7]

MARKETING IN GREAT BRITAIN

The system of marketing local supplies in Great Britain is more highly organized and has more variations than the continental system. It also is much more influenced by the import trade. There is the same simple system of provisioning the smaller places when but little foreign meat is sold. Live animals are also sent by rail to London and other large cities where they are sold in stockyards on commission. Sometimes the farmers themselves consign their stock to market. Most of the animals in England are sold at auction at district markets or fairs. The buyers at these markets are small butchers and dealers. In Great Britain an important part of the supplies is slaughtered in the country or small towns and shipped to the cities as dressed meat. Very little slaughtering is done on the farm except in the case of pigs. Even pigs are

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[6] A. Brenning, "The Coöperative Sale of Live Stock in Germany," *International Review of Agricultural Economics*, October-December, 1923, pp. 453-462.

[7] *Agricultural Coöperation and Rural Credit in Europe*, U. S. Senate Document No. 214 (1913), pp. 624-634; A. Sonnichsen, *Consumers' Coöperation*, pp. 85-106.

usually shipped to bacon factories. Cattle and sheep or lambs are frequently slaughtered by local slaughtering concerns in the country and the meat shipped to London or some other large city to be sold on commission on the farmer's account. Farmers sometimes ship their own stock to city butchers to be sold in the same manner. Most of the animals, however, are sold outright by the farmers, and the dealers assume all risks in marketing from then on. A very surprising part of this trade is conducted at a per-head price, the animals not even being weighed. The dealers may ship the animals alive to some large city or may slaughter them, have them slaughtered or sell them to a slaughtering concern before the meat is put on a local market or shipped to a large city to be sold, usually on commission. Most towns are supplied with municipal slaughterhouses where the animals and meat are carefully inspected, but there are many private slaughterhouses where inspection is not so rigid. Large slaughtering establishments run by one private concern, similar to the American packing houses, are not known.

London has the largest meat market in the world. This is what is popularly known as the Smithfield market where many commission houses, importers, wholesalers, brokers and even retailers do business in the municipal market house. The largest part of the meat sold there, as indeed in the other large city markets, is the imported product, but large quantities of home-grown meat are also sold there. The home-grown meat is the product shipped there from country points to be sold on commission or the carcasses of animals shipped to the London live-stock markets and slaughtered by the city butchers. Apparently the best of the meat from imported live stock is also sold as home-grown. Smithfield market is the great fresh meat market for England, and sets the prices for the whole country as Les Halles Centrales, the meat market in Paris,

sets the prices for France. Formerly Smithfield functioned as a central market for many of the incoming supplies for other English cities. This reshipment trading has lost its importance and now much of even the meat arriving at London is sent direct from the docks to the "provincial" markets.[8] The center of the pork-products trade, particularly from North America, is Liverpool rather than London.[9]

The trade in cured pork products and lard is in the hands of a different group of tradesmen. The bulk of the domestic product is factory cured, and most of the imported bacon is smoked or otherwise processed after it reaches the hands of the British trade. Wholesaling and retailing are conducted largely by houses who handle provisions, such as dairy products, and groceries.

Retailing of fresh meat in Great Britain is in the hands of three different types of stores, independent shops under private management, multiple shops under centralized management and coöperative shops. The latter are frequently associated with the Coöperative Wholesale Society of either England or Scotland and fill a very important place in the marketing system. The multiple shops are, to a large extent, associated under common management with one of the large British importing companies.

The imported meat takes a leading place in the larger city markets. Much of this now comes in to a branch of the importing, or rather international, concern which has slaughtered the meat in a foreign country. Some still is shipped from distant lands on consignment, especially lamb from New Zealand. Farmers in that country may

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[8] Department Committee on Distribution and Prices of Agricultural Produce, *Interim Report on Meat Poultry and Eggs* (London), 1923, pp. 15-102.

[9] E. C. Squire, *Marketing American Pork in England*, U. S. Department of Agriculture, Report F. S. 27.

sell through their coöperative freezing concern and have their particular lambs separately labeled and sold in Smithfield market on separate account. Most of the foreign supplies now, however, are the property of importing companies before they reach England.

MARKETING IN THE SOUTHERN HEMISPHERE

In Argentina, what the export trade would call the poorer animals go into domestic consumption. The cities maintain public abattoirs, the largest of which is at the Liniers market in Buenos Aires. The local slaughtering concerns buy animals and kill them in the municipal abattoirs. This meat is seldom put in refrigerating chambers, but is sold at retail on the markets the next day. The *frigorificos* or export slaughtering houses also provide some of the local supplies of meat.[10]

Marketing facilities for the local trade are also provided in Australia. At Sydney, in New South Wales, the municipal authorities supply extensive salesyards for animals, abattoirs and a central meat market. The operations in the market places, however, are all conducted by private agencies. Thus the marketing operations are modelled largely on those of Great Britain.

The export trade of the leading export countries of the Southern Hemisphere is largely in the hands of the larger export companies, except in New Zealand where coöperatives are very important. The animals are usually bought at the farm or ranch and shipped by rail to the slaughterhouse at the seaboard. In some cases the animals are shipped to central stockyards to be sold on commission. The export companies maintain large slaughterhouses and refrigerating plants where the meat is chilled or frozen

[10] Bergman, *op. cit.*, pp. 38-40.

and loaded direct into special refrigerated steamships which move the product direct to the European market.[11]

MARKETING IN NORTH AMERICA

North America has many marketing practices which are very unlike those of the Old World. The simpler operations for country and village trade are not so dissimilar to some of those in other countries, only municipal abattoirs are unusual and central meat markets, either wholesale or retail, owned by the public authorities play a smaller part in the marketing of meat. A large part of the meat consumed is handled by the packers. The differences between the system in the United States and Canada are not very great.

The United States in particular has an extensive system of stockyards where the animals are usually shipped on consignment, being transported in special live-stock cars. Many shipments to the yards are now being made by co-operative live-stock shipping associations which are to a certain extent supplanting the country buyers as country assemblers in making up carloads for more economical shipment.[12] In some cases the packers send their buyers direct to the country and buy at the farm for direct shipment to the plant. Wherever possible, however, they leave the shipment from the country to be made by the farmers themselves, their coöperative agents or country buyers, and the animals are sold in the stockyards by commission men to the agents of the packing houses. The stockyards are much more highly developed than the European live-stock markets. Most elaborate systems of pens, alleyways and

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[11] *Report on the Trade in Refrigerated Beef, Mutton and Lamb;* Critchell and Raymond, *A History of the Frozen Meat Trade.*

[12] R. H. Ellsworth, *Livestock Marketing Associations in the United States* (1924), U. S. Department of Agricultural, Preliminary Report.

runways are provided for keeping each lot of animals separate while they are being unloaded from the cars, fed and watered, sold, weighed and sent to the packing plants or put in cars again to be shipped to some other country points for fattening. These yards are chiefly owned by the packers to whom credit is due for their present high state of efficiency.[13]

Wholesale slaughtering operations are known as "packing" in North America for reasons that will appear later. The operations in these packing plants are very much more elaborate than in the abattoirs of the Old World or the country slaughterhouses of any land. They are modern, large-scale manufacturing plants where the animals are slaughtered as expeditiously as possible and their meat and other products made ready for market in the most careful manner. Inspection of the live animals and their carcasses is made by government agents during the process. From the time the animal enters the process until its carcass is in the large refrigerated chambers to be cooled it is kept moving suspended from an overhead track, thus allowing of the most specialized labor in dressing the carcass as it passes along before a considerable number of men, each trained to do his own particular small part of the process. All carcasses are sent to the cooler to harden and the good quality of beef, mutton and lamb is shipped as sides or carcasses. Most of the pork is cut up in the packing house and the larger part of the carcass is put through a curing process. All excess fats are rendered and those that are fit for such a purpose are made ready for edible uses; the rest are sent to the soap house. The hides go to the tannery. The scraps of meat are made into sausage and other prepared meats. Everything is made ready for the most profitable use

[13] R. A. Clemen, *The American Livestock and Meat Industry*, pp. 534-554.

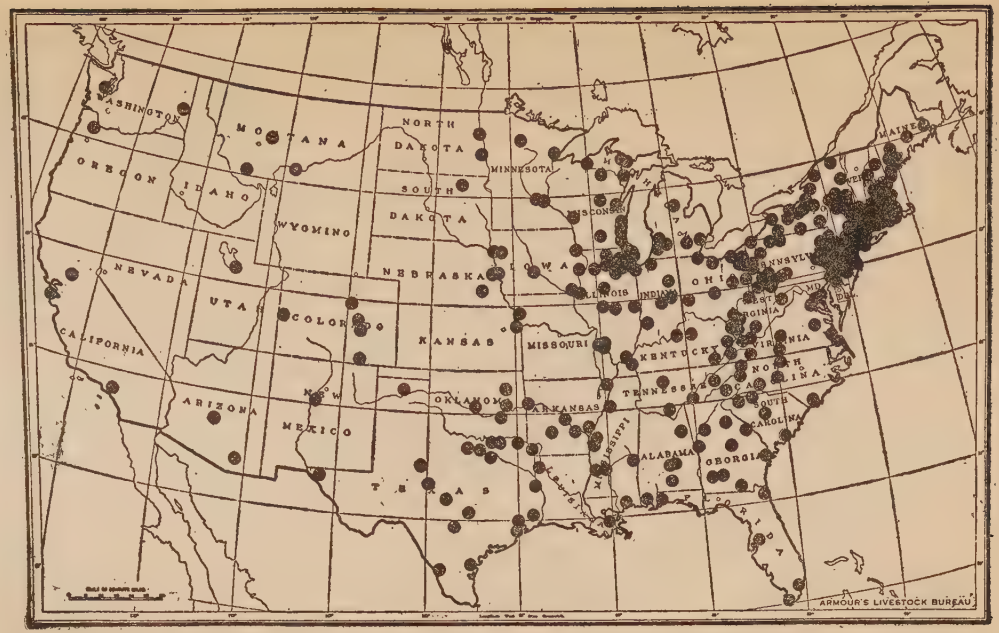

CHART 26.—THE ARMOUR AND MORRIS BRANCH HOUSE SYSTEM.

The scale of the map does not permit the great number of houses in the East to stand out separately.

CHART 27.—THE ARMOUR AND MORRIS CAR ROUTE SYSTEM.

Figures indicate number of cities and towns served in each state from each plant. The location of the plant is marked with a star. Branch house car routes are not included.

possible, fertilizer material being the lowest important grade of product sold.[14]

Practically none of the meat is sold in public wholesale market places in the United States, but in some cities there is a considerable retail distribution conducted by private agencies in centralized public markets.

Most of the edible products are sold through the branch houses of the packers or shipped out by rail in what have commonly been called "peddler cars" to dealers along various lines of railway. The leading packers have branch houses or wholesale establishments all over the more densely populated part of the east and in the larger cities in the south and west. There are approximately 2,000 such establishments in the United States. These branch houses sell direct to retailers in the smaller cities and towns and in the larger cities either direct or through jobbers to the retailers.

Smaller cities and towns in the middle west, west and south are served by means of direct shipment in refrigerator cars which carry supplies direct to retailers in the smaller towns along established routes. These cars are refrigerated and the goods are packed in them to fill orders from country retailers. The cars are loaded in such a way that the goods for the first stop are nearest the door, thus saving the railway agents all unnecessary trouble. The first stop is sometimes at a considerable distance from the packing plant, but from that point on to the final destination there usually are goods for all stations. Practically all rail distribution is by means of refrigerated cars.[15] The charts on pages 539 and 540 show the branch

[14] A. Cushman, *The Packing Plant and Its Equipment*, Lecture III in Institute of American Meat Packers Series at Chicago University.

[15] H. C. Marshall, *Retail Marketing of Meats*, U. S. Department of Agriculture, Department Bulletin, No. 1317, p. 6; L. H. Haney, *The Case Against the Meat Packers as seen by the Wholesale Grocers of the South; Interstate Commerce Commission Reports*, Vol. 62, pp. 375-403.

houses and car-route systems of one of the large packers.

Refrigeration plays an important part in the marketing of domestic supplies of meat in America. Pork products, while manufactured throughout the year, are handled in greatest volume seasonally as the pig crop is marketed, and the surplus is put into cold storage at a freezing temperature until the season of lesser production. In this manner an uneven supply is fitted to a relatively even demand.

Although the supply of beef is also seasonal, less than 5 per cent of the beef supply in the United States is held in cold storage for any length of time. It is true that if beef is frozen solid, it can be held in storage for months without noticeable deterioration; but the American trade does not like frozen beef, and the result is that the packers have to sell their beef while it is still fresh and sweet. This means that it has to be sold within two or three weeks after the cattle are killed. After the retailers have bought fresh beef from the packers, they often allow it to "ripen" for another week or two before selling it to consumers. This adds to its tenderness. Because of its perishability, beef is, of course, handled under refrigeration in the packing house, in the refrigerator car, in the packer's branch house and in the retail store.

The beef supply of the United States is very much heavier in the fall and early winter than it is during the rest of the year because of the receipts of range- or grass-fed cattle. Since beef has to be moved while it is fresh, this means that the American people eat much more beef during the months of heavy marketing. The beef supply can be equalized only to a very limited extent by retarding its movement during seasons of flush production and by moving it more quickly at other times. As we have seen, however, the peaks of the marketings of different sections are thrown together by the national marketing system of

the packers, thereby reducing the irregularity of beef supply.[16]

The commercial systems of the packers are very elaborate, but there is no other large-scale meat marketing system in North America. The multiple-shop system of selling fresh meat in Great Britain has no extensive counterpart in the chain stores of America. The packers have no retail stores in the United States and only a few in Canada. The chain grocery stores usually handle cured meats, but seldom handle fresh meats. There are a few chain meat stores, however, which handle fresh meats.[17] By far the largest part of the retail meat stores are independent and the number of those operated coöperatively by consumers is negligible. Opinion is divided as to whether or not the packers should go into the business of retailing. Since these concerns are themselves opposed to the idea, the question is purely academic at present.

COSTS AND PROFITS OF MARKETING

The costs and profits of the marketing systems present a fertile field for suspicion to those who see nothing but the live-weight price of cattle and hogs on the farms and the retail price of the choicest cuts of meat in the stores. It is difficult to see that ten cents a pound for cattle and seventy-five cents a pound for steak do not mean exorbitant profits somewhere. The packers, who possess a concentration of wealth and whose aggregate profits run into large figures in a normal year, frequently are accused of taking too large a toll for their services.

Part of the difference between the farm price of live stock and the retail price of the popular cuts of meat is due to marketing expenses, most of which have been found

[16] F. E. White, *Distribution of Meat Products*, Lecture VIII, Institute of American Meat Packers Series, University of Chicago, p. 337; letter from L. D. H. Weld to author under date of Aug. 26, 1926.

[17] Marshall, *op. cit.*, pp. 10-13.

so far to be unavoidable. Another part of the difference is due to the profits of the various middlemen from country buyers, through the packers to the retailers. By far the largest part of the difference is due to the fact that the price of a very limited and choice part of the carcass

Proportion of the Consumer's Beef Dollar Received by the Producer for the Beef Content of the Live Animal

	Amount	Per Cent	
Consumer pays for beef	$87.68	100.00 %	
Retailer's expenses and profit	19.33	22.0	22.0 %
Packer's expense and profit	13.55	15.5	15.5 %
Transportation and marketing expense (live animal—beef content)	4.11	4.7	4.7 %
Farmer receives for beef content of his animal	50.69	57.8	57.8 %

CHART 28.

(From *Yearbook*, 1925, Swift & Co., p. 44.)

is usually compared with that of the whole live animal which contains much weight that has a small value compared with the average price and especially with the price of the choicest meat. These cheaper parts of the carcass and the products that are almost all waste are never seen by the meat consumers excepting in unrecognizable form. Much of the live weight, of course, is offal. Cattle usually give a dressed weight of only 50 to 60 per cent and hogs of about 70 to 76 per cent of the live weight.

The accompanying chart published by one of the leading

packers shows roughly into what elements the dollar was divided that the consumer spent for fresh beef in 1923. This presentation of the situation is much more conservative in showing the large proportion actually going to the farmer than a more elaborate one made in 1922 by the Congressional Joint Commission of Agricultural Inquiry.[18] Most of the retailer's margin is expense. A study recently made by the United States Department of Agriculture shows that, in the stores studied, the average retailer got 2.37 cents net profit, paid 16.65 cents for actual expenses and paid 80.98 cents at wholesale for the product out of every dollar paid him by the consumer for all meat.[19] The 15.5 per cent shown in the chart as packer's expense and profit on beef includes the costs of transportation and wholesale marketing as well as the packing-house costs. The Joint Commission referred to above allowed 4.2 cents of the consumers' dollar for selling costs, 5.3 cents for meat transportation, 5.6 cents for packing expense and 1.5 cents for the packers' actual profit in 1920-21.[20] The chart is based upon a packer's profit of less than 1.5 cents for that year.[21] All such figures must be based upon more or less arbitrary accounting methods, but considerable collateral evidence, brought together by official "profiteer hunters" as well as members of the trade, indicates that the chart shows the situation accurately. In this case, the farm price of the animal and the packing expenses having been split up on the basis of the relative value of the total value of the beef and of the by-products, only that part of these costs belonging to the meat have been used. Thus the disturbing factor of hides and other non-edible by-products has been eliminated.

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[18] *Report of the Joint Commission of Agricultural Inquiry,* Part IV, "Marketing and Distribution," pp. 217-218.

[19] Marshall, *op. cit.,* p. 62.

[20] *Report of Joint Commission, loc. cit.*

[21] Swift and Company, *Year Book,* 1925, p. 17.

Another chart published by the same company sheds light on their total cattle operations for the same year, including the hides and other by-products. The facts presented may be compared with the report of the Commissioner of Corporations in 1905 who found that the same company made a profit of about 1.9 per cent on the total volume of sales.[22] The profits for the year 1923, as shown in the chart, are reported to be about equal to the average

Cattle Operations, Fiscal Year 1923

	Per Cwt. Live	Per Cwt. Dressed	Per Head
	$	$	$
Received for Meat 530 lbs. avg. weight	6.97	12.91	68.35
Net Returns from By Products, Incl. Hides	1.24	2.30	12.17
Total Received	8.21	15.21	80.52
Paid for Live Cattle 981 lbs. avg. weight	6.83	12.65	66.97
Total Expenses, Including Freight	1.27	2.35	12.45
Profit—Before Charging Interest	.11	.21	1.10

CHART 29.
(From *Yearbook*, 1924, Swift & Co., p. 18.)

for the years 1915 to 1923 and the year 1922 shows the greatest profits with $2.52 gain before charging interest. The years 1919 and 1920 were unprofitable in comparison with other periods.[23]

The greatest disparity in price appears between the wholesale price paid by the retailers and the retail price of fancy cuts which are frequently, though wrongly, placed side by side for comparison. The retailer may not be as efficient as he might be and it appears from a wealth

[22] *Report of the Commission of Corporations on the Beef Industry*, 1905, p. 269.
[23] Swift and Company, *Year Book*, 1924, pp. 18, 19.

of evidence that the retail system in North America cannot get along on less than about 20 per cent gross margin and frequently requires more. In Great Britain the "normal gross profit," or margin, has recently been found to be 10 to 15 per cent on the turnover.[24] It seems strange on first sight that retailing requires so high a margin when the whole packing operation, transportation of meat from one city to another and the expenses of wholesaling call for only about 15 per cent. The probable reason is that the business is more expensive generally per unit of turnover than the wholesale marketing functions. However, even 20 per cent retail margin is small compared with the difference between the wholesale price of a quarter of beef and the price of the cuts of which the most is heard. If the whole of a side of beef were fancy steak the retailers would get wealthy, provided they could maintain the present prices for the steak. Of course, the reason the price of steak is high is that, in addition to its desirability, it is decidedly limited in quantity or proportion in the carcass. There is a decidedly different strength of demand for the different parts of the carcass. The shin-bones are almost worthless. Some of the forequarter is relatively unpopular. The price is put up on each cut in proportion to the strength of demand for that particular cut and some parts are sold below the average cost of the carcass and some much higher. The total return from the retail sale of all the parts of the whole carcass must amount to the total wholesale price plus the 20 to 25 per cent margin for costs and profit, some of the cuts selling above, and some below, the average price. The following chart shows this point graphically. The prices for the particular cuts not only vary from the average, but vary from store to store, those stores in the best residential sections charging

[24] *First Report of the Royal Commission on Food Prices*, 1925, p. 94.

still more for the fancier cuts and perhaps less for the poorer classes of meat.

Hog carcasses are generally cut up by the packers or other manufacturers and sold by the retailers with rather less attention to price differentiation. Even in the case of bacon, however, that is sliced in the stores, the retailer has ends left over that must be sold below the price of the

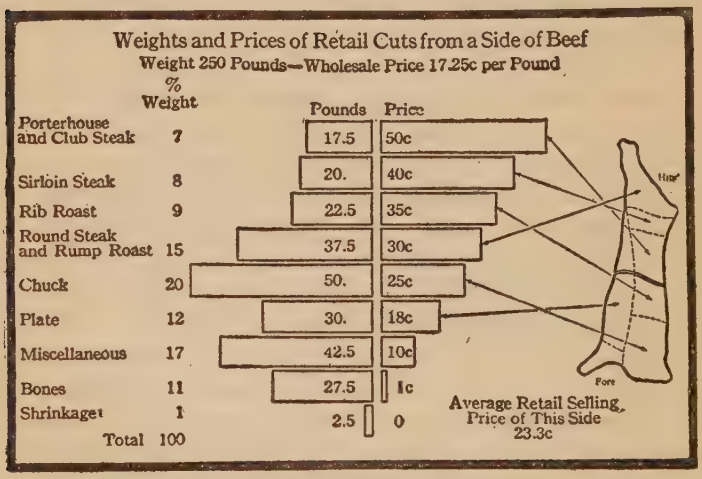


CHART 30.
(From *Yearbook,* 1921, Swift & Co., p. 27.)

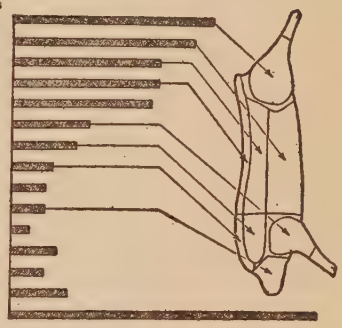
slices and this raises the price which he must charge for the sliced product. The main task of apportioning the total cost of the carcass to the separate parts and by-products falls on the packer in the case of hogs. The accompanying chart illustrates the yield of the various products in the typical practice of pork cutting in the United States at present.

Within these past few years very much more attention has been paid to the scientific analysis of marketing problems. What the final result may be is not certain, but much optimism is felt regarding the possibility of cheapen-

ing marketing processes of foodstuffs in general. The packing and distribution of meats show the best results at present from the standpoint of the proportion of the consumer's dollar taken for their services among all the many branches of commerce studied by the Congressional Joint Commission. It would appear that its efficiency had just about kept pace with increased efficiency in live-stock pro-

Pork Products from a 250-Pound Hog—Finished Weights

	Per Cent	Pounds
Hams, Smoked	13.00	32.50
Bellies or Bacon	11.75	29.37
Loins, Fresh	9.50	23.75
Fat Backs, Salted	9.50	23.75
Lard, Rendered	9.00	22.50
Picnics, Smoked Shoulder	5.00	12.50
Boston Butts, Fresh	4.25	10.63
Clear Plates, Salted	2.75	6.87
Lean Trimmings, Sausage	2.25	5.63
Jowl Butts, Salted	2.25	5.62
Spare Ribs, Fresh	1.25	3.13
(1) Misc'l Edible Items	3.00	7.50
Yield	73.50	183.75
(2) Edible By-Products	2.25	5.62
(3) Non-Edible By-Products	3.75	9.38
Shrinkage	20.50	51.25
Total Live Weight	100%	250 lbs.



(1) Including: feet, neck bones, tails, brains, cheek and head meat, ears, lips, and snouts.
(2) Including: plucks, gullet meat, weasand meat, giblet meat, tongues, kidneys, and stomach linings.
(3) Including: casings, blood, hair, grease, and tankage.
NOTE—Although this method of cutting is typical, proportions vary with trade requirements.

CHART 31.
(From *Yearbook*, 1922, Swift & Co., p. 33.)

duction in the last generation. Evidence presented by packer representatives before the Secretary of Agriculture and based upon government data shows but little net change in the relation between prices of live stock, meat and hides since 1890.[25] Retailing takes a much larger toll and offers greater possibilities for increased efficiency. Further

[25] Wentworth Exhibits 16 and 17, *Brief of Law and Facts on Behalf of the Armour Respondents in the Case of the Secretary of Agriculture vs. Armour and Company, et al.* (1925), pp. 476, 477.

scientific and practical study of meat-marketing problems should tend to cheapen the processes somewhat and make them in other respects more satisfactory to both producers and consumers. It must be emphasized, however, that marketing is just as truly a productive service as is the raising of live stock and that this service will always have its costs.

CHAPTER XV

COMBINATIONS IN THE MEAT TRADES

"Big business" in various forms has had a profound influence in the development of the meat industry as it exists in a number of the leading countries. The production of live stock is always conducted in enterprises which, while sometimes covering many square miles with thousands of cattle or sheep, are small compared with the output of any one nation. The slaughtering of the animals and the marketing of the meat and other products, on the other hand, under the conditions of modern international trade and internal trade between different parts of the largest countries is to a large extent conducted in very large-scale enterprises.

The American "packers" are world famous for their large operations in meat and related products. These concerns which grew up in the United States now have an important part in the domestic meat business of Canada as well as in their home country and conduct an international trade from North and South America and Australasia, selling and distributing their products in the British Isles and the other leading nations of western Europe. They also do business in many other countries, as shown by the accompanying chart. These concerns are popularly supposed to work in such close harmony as to constitute a single combination. They themselves vigorously deny the charge that they act in concert and many of those who have business dealings with them support their denial. Recent developments suggest that these concerns may have

reached the zenith of their relative importance. Exporting enterprises in Australasia and South America and importing enterprises in Great Britain have also assumed the proportions of big business. The leading example in this latter group is the combination of concerns under the control of the Vesteys, now of England, which has recently sprung into great prominence. Farmers' coöperative marketing ventures have held a very prominent position in various branches of the live-stock and meat trades in some countries, but have hardly assumed the proportions nor adopted all the methods of big business. Recent governmental ventures in Argentina and New Zealand have much more nearly approximated in aim what are popularly supposed to be the methods of big business combinations. Such aims appear, however, not to have been attained. The operations of the wholesale societies of the consumers' coöperative associations also attain large proportions. Their aims are quite contrary in many respects to those of the combinations of private enterprise. The nature of these two types of business brings them into competition with each other and the coöperative type acts as a limiting or regulating influence on the activities of the type which operates for private profit. In some of their essential influences in the problems of nation-wide and international marketing all these types of combinations, however, have similar effects.

THE AMERICAN PACKERS

The American packing business came into prominence in the last century when the live-stock industry of the center of the United States was growing rapidly and its surplus products were cured and packed for shipment to the consuming centers. The actual packing operations date from early colonial times, but large-scale packing be-

CHART 32.—ARMOUR AND MORRIS FOREIGN HOUSES (STARS), AND AGENCIES (DOTS).
(From Monthly Letter to Animal Husbandmen, July, 1924, Armour's Livestock Bureau.)

came possible only after modern transportation methods stimulated the geographical specialization of industry and agriculture. The packers as they are known to-day really originated in the middle of the last half of the recent century when refrigeration brought in a new type of national meat distribution which largely superseded what were strictly speaking packing operations. The modern packers "pack" but little meat now, but the term "packer" has been retained and applied to the modern industry of the wholesale slaughtering of stock and the large-scale marketing of meats and related products which uses the modern arts of refrigeration and curing rather than the antiquated method of packing and shipping in pickle.

In 1875, G. F. Swift, who had been in the dressed meat business in New England, moved to Chicago and began operations there. In the same year P. D. Armour established himself permanently in Chicago. Soon after that time, refrigerated cars for the shipment of dressed beef by rail were being developed to a stage of practical operation. The new era of modern meat packing in the United States began in that period. Previously there had been a considerable nation-wide distribution of beef on the hoof and of pickled pork and beef. The perfection of the arts of refrigeration inaugurated a much larger distribution of the more desirable forms of meat.

Hitherto the meat business had been largely on the local marketing basis. The bulk of the supplies in all lands moved but a small distance from producer to consumer. There was but relatively little geographical differentiation in food production, the live stock that did move was slaughtered and the products marketed by butchers operating on a local basis on a relatively small scale. The new packer system revolutionized all this. It reduced the difficulties of transportation and gave relatively free rein to

the forces which stimulate the geographical specialization of industry and food production. The packers were both the cause and the effect of the new order. It might perhaps be more accurate to say that they were the means through which powerful economic forces acted to revolutionize the meat industries when modern distribution technique became possible. Nation-wide and world-wide distribution of perishable products must of necessity have big business in some form for their most efficient development. The problems of such distribution cannot be solved by enterprises of small size or restricted to small local fields of operation. The leaders in the packing industry were the cause of the new order in that they actively engaged in developing the machinery necessary to its success and won the commercial battles necessary to overcome the prejudices and vested interests which would have tended to preserve the old order in spite of economic pressure. It probably was inevitable that they should make themselves very unpopular in many quarters while thus actively introducing a new order of meat marketing. How much public distrust could have been averted had more care been taken to avoid it in the earlier days is a real question. It also is a question whether or not these large enterprises would have grown so rapidly as they did if the business methods which were common to the time, but never in popular favor, had been avoided more carefully. It does seem certain, however, that the broad issues of the specialization of producing areas and the growth of big business to solve big marketing problems were founded upon the development of economic forces which would have operated in about the same manner in any case. The detailed business policies of the packers were of minor importance as compared with more powerful economic forces.

The local butchers in the eastern markets could hardly have been expected to welcome the new order. The farmers

in the east had greater reason to resent it. The railways, which were fully as responsible for the underlying changes as the packers, at first opposed the new move because they were prepared to transport the live animals rather than the dressed meats. The packers were driven to supplying their own refrigerator cars and some had difficulty at first in getting the railways to move them to the eastern markets. The consumers also had a prejudice against refrigerated meat. This prejudice was encouraged by interested parties and did not disappear until a national system of inspection of quality was introduced that rendered the refrigerated meat much more dependable in quality than the locally slaughtered product ever has been. The packers attacked this marketing problem and the larger one of supplying local marketing facilities in the east by making commercial alliances with leading established meat merchants in the eastern cities. These merchants had an established outlet for meat and the new product was gradually pushed into the old channels of trade. At the same time the packers were acquiring branch selling houses all over the leading consuming sections of the country, for these local partnerships soon became absorbed into the national marketing systems. They established "peddler car routes" in sections of the country where they had no branches. The packers were also providing live-stock yards for the handling of the animals as they came on the market and, in addition to their large slaughtering and storage plants, they were building up facilities for manufacturing and merchandizing all manner of by-products. These phases of the development of the industry were largely completed by 1890.[1] Some of the men in the industry had been interested in side lines, such as grain marketing, from the beginning. In the present

[1] R. A. Clemen, *American Livestock and Meat Industry*, pp. 3, 92-109, 146-172, 211-225.

century and culminating in the last years of the war the policy was developed of branching out into the merchandizing of many lines of food products. Butter, cheese and poultry products are customarily handled in conjunction with meats, but canned fruits and vegetables, rice and many unrelated lines of goods were added to the commodities marketed by some of the packers and, although the amount of such goods handled by the packers was comparatively small, the popular cry went up that nothing short of a giant food trust was establishing itself not only for the United States, but the world.[2]

Possibly the collapse of prices in 1920 tended, at least for a time, to check the move toward expansion. Whatever the reasons, the leading packers voluntarily relinquished many of their side lines in the famous "Consent Decree" of 1920 and promised not to enter the uninvaded field of retailing. Statistics prepared by Armour's Livestock Bureau also show that the proportion of federally inspected meat handled by the large packers declined after the war to approximately its earlier basis.[3] Geographical specialization in meat production in the United States has probably reached its limit. The pioneer days of the new order in meat marketing have passed and smaller concerns can imitate what they might not have originated. The chief determining factor now should be the relative efficiency of business units of different sizes and there is a grave question if the advantage is with extreme size in marketing operations. In any event the growth of the comparative importance of the large packers seems now to have been passed in the United States.

The packers have been investigated at different stages of

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[2] *Report of the Federal Trade Commission on the Meat-Packing Industry*, 1919.

[3] Letter to author from E. N. Wentworth, Armour's Livestock Bureau, May 21, 1923.

their history by agents of the United States government. The Commissioner of Corporations found in 1905 that "the Big Six" (*viz.*, Armour, Swift, Morris, the National Packing Co., Schwarzschild and Sultzberger, and Cudahy) operated a smaller proportion of the beef industry of the country than ordinarily supposed and that comparatively narrow limits were placed upon "the control which they could, even if they acted in harmony, exercise over the prices of cattle and of beef." The Commissioner stated that the most important question had "to do with the prices of cattle and of beef, and the margin between them, and with profits." It was concluded after careful examination of the books of the companies that "the profit of the packer per head or per hundred pounds of dressed beef is relatively small, and that it can not exercise a very important influence on the cattle raiser or on the consumer of beef." It was also stated that, "while the large scale on which the packers do business thus enables them to make good profits on a small margin per unit of product, it also serves so to reduce the expense of slaughtering and dressing cattle that the consumer is undoubtedly getting his beef more cheaply than he possibly could have done if the business had remained in the hands of local butchers or of concerns of comparatively small size. The saving which the large western packers effect in the cost of operation and in utilization of by-products, as compared with old-fashioned slaughtering establishments is materially greater per head than the profit which they secure."[4]

The Federal Trade Commission, which succeeded the Commissioner of Corporations, reported on the meat-packing industry in 1919. At this time the packers were at the zenith of their expansion into other fields, prices in

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[4] *Report of the Commissioner of Corporations on the Beef Industry*, 1905, pp. xxi, xxiii, 268, 269.

general and of meats in particular had been rising very rapidly for some years to the great vexation of the public, and public agencies such as the Federal Trade Commission were under popular pressure to bring in indictments against profiteers whenever possible. This report was a bitter attack against the packers, accusing them of all manner of unfair trade practices and actions tending to produce a monopoly in the meat business. The Commission stated that, in answer to the question as to whether or not there existed "monopolies, controls, trusts, combinations, conspiracies, or restraints of trade out of harmony with the law and the public interest, we have found conclusive evidence that warrants an unqualified affirmative."[5]

The publication of this report apparently injured the packers both at home and abroad. It was noted with real concern by the public authorities in other countries, and as a result liberty was denied these concerns to do business in New Zealand. The British authorities also expressed grave concern over the degree of their national dependence upon foreign companies adjudged by their home government to be conducting their business on policies seriously at variance with the public interest.[6] It would appear that, as a result, that government has assisted its nationals in attempting to limit the influence of the American packers. To combat the influence of the report in their home market the packers issued lengthy public statements, with supporting exhibits, directly charging the Commission with conducting a one-sided investigation, deliberately falsifying major issues and presenting partial

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[5] *Report of the Federal Trade Commission on the Meat-Packing Industry* (1919), Summary and Part I, p. 23.

[6] *Report of the Committee Appointed by the Board of Trade to Consider the Means of Securing Sufficient Meat Supplies for the United Kingdom* (United Kingdom, 1919), Cd. 456.

evidence in such a manner as to deceive the public.[7] The fact that the zeal of the Commission caused it to criticize even such natural practices as the control by the head office of each company over the policies and prices of its branches helped the packers to win some degree of popular support against the findings.[8]

Following this investigation the packers voluntarily agreed to curtail their outside operations and became parties to a "Consent Decree" issued by the Supreme Court of the District of Columbia.[9] Congress also, after much debate, took the jurisdiction over the packers out of the hands of the Federal Trade Commission and, in the Packers and Stockyards Act, vested it in the Secretary of Agriculture. The Commission found that the profits of the packers were large in 1917. With the break in prices after the war profits turned for a time to losses in this as in most other industries. The report of the Congressional Joint Commission of Agricultural Inquiry in 1921 indicated that the profits of the packers were very moderate when compared with the prices of live stock or meats.[10] In a recent decision on the question of allowing the merger of two of the "Big Five," the Armour and Morris interests, the Secretary of Agriculture allowed the Armours to retain their acquired Morris properties and made the following statement regarding competition and business practices:

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[7] *Swift and Company's Analysis and Criticism of Part II of the Report of the Federal Trade Commission on the Meat-Packing Industry.*

[8] See *Report of Federal Trade Commission,* Summary, p. 25, and Part II, p. 42.

[9] U. S. A., Petitioner, *v.* Swift and Company, *et al.,* 37623 Equity, Washington, 1920.

[10] *Report of the Joint Commission of Agricultural Inquiry,* 67th Congress, U. S. (1922), Part IV, "Marketing and Distribution," pp. 217, 218.

Much evidence was introduced both by the Government and the respondents as to the effect of competition before and since the acquisition. The overwhelming weight of the testimony is in favor of the view that competition has not been materially lessened by reason thereof, either in the buying of live stock or the sale of the meat or meat products thereof. Scores of independent packers were called by the respondents and they all testified that in the handling and sale of meat and meat food products competition has been keen and active. Many large retail dealers scattered throughout the country were placed on the stand by the respondents and they testified that competition was keen and active and that no unfair practices or coercive methods had been engaged in by Armour & Company. The evidence further discloses that during the last decade both the number of independent packers of substantial size and the volume of business done by them have largely increased.[11]

PACKERS IN CANADA

In Canada the "Big Five" have held a position of minor importance compared with the Canadian companies. The packing industry has had its share of official investigation with a varying degree of fairness. During the war one official report was published virtually exonerating all the packers from cause for complaint with the exception of one concern controlled by a gentleman at the time in charge of the control of munitions in the Dominion. It was brought to light later that such an attack had been sought by certain business interests whose operations that gentleman was holding in line with public interest in his official capacity as Chairman of the Munitions Board. The packers in Canada, like other business men, are in business for private profit, but the present writer found, while intrusted with investigating trade combinations in the Dominion, that the packers are as public spirited as any group of men in the country and that their business

[11] Conclusion and Order of Hon. William M. Jardine, Secretary of Agriculture of the United States (*in re* Armour-Morris Case), p. 10.

methods were superior to some of the other leading interests.[12]

THE AMERICAN PACKERS IN FOREIGN COUNTRIES

There have been several investigations of the meat business in Great Britain which have considered the problem presented by the influence of the American packers in the British market. The Departmental Committee which reported in 1909 on the question of combinations in the meat trade stated that in their opinion a measure of combination existed among the representatives of the "United States Beef Trust." The Committee stated, that "we should describe the companies as carrying on their business in coöperation rather than in competition but it should be said that this coöperation appears to be for the purpose more of advancing their own interests than of acquiring the trade of others." Their conclusion was that "the combination which exists to the extent which we have described between four of the United States companies engaged in the beef trade in the United Kingdom is not at present sufficiently powerful to be a serious danger to the beef trade as a whole."[13]

The British official investigators have expressed some uneasiness lest the American companies should acquire too large a position in the British trade to the injury of British companies, and some consideration has been given to schemes for government interference to protect home industry. The Inter-Departmental Committee on Meat Supplies which reported in 1919 referred with some anxiety to the growing importance of "The United States Meat Companies" and noted the charges brought against

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[12] McFall, "Regulation of Business in Canada," *Political Science Quarterly*, Vol. XXXVII, No. 2 (June, 1922), pp. 177-210.

[13] *Report of the Departmental Committee Appointed to Inquire into Combinations in the Meat Trade* (U. K., 1909), Cd. 4643, pp. 9, 15.

them by the Federal Trade Commission. The report pointed out with concern that the Argentine beef trade was coming increasingly into the hands of the American packers. In 1909, the British companies had 37 per cent, the Argentine companies 27.7 per cent and the American 35.3 per cent of the Argentine export business. After serious trade wars the distribution became 26.4 per cent British, 14.6 Argentinian and 59 per cent American during the early part of the war. In 1918 the share of the American companies was forced up to 68.1 per cent of the conference allotments. When the business of the Vestey and Las Palmas plants was considered, the American concerns had 57.2 per cent of the output from the River Plate. This Committee recommended that the government take steps to encourage British industry in their meat import trade.[14] The Sub-Committee of the Standing Committee on Trusts reporting in 1920 "found through all branches of the meat trade a general apprehension that the American meat companies were aiming at world dominion. It was asserted that they at present dominate, not only the United States, but South America, and that they have a solid footing in Canada and Australia. Fears as to the extension of their activities are not confined to this country, but are equally strong in Australia, New Zealand, and

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[14] *Report of the Committee Appointed by the Board of Trade to consider the "Means of Securing Sufficient Meat Supplies for the United Kingdom"* (United Kingdom, 1919), Cd. 456.

A report from American Trade Commissioner Brice M. Mace, Jr., under date of November 4, 1925, gives the following percentage division of the export trade from Argentina following a recent trade war:

Country	1924	1925
North American	55.55%	65.98%
British	30.93%	19.15%
Argentine	13.52%	14.87%

Canada. The more they may be able to extend their operations in South America, the more they may be able to divert necessary supplies from this country, and the more they are able to control distributive business in the United Kingdom, the more securely will they have the British consumer in their grip at the end. Without necessarily endorsing all the fears that have been expressed, we do concur in the opinion of the home trade, that it is not a healthy condition of affairs when in 1913 the American companies controlled over 45 per cent of the supply of all beef, home-raised and imported, at Smithfield market, and the danger is not lessened by the fact that the strength of the American companies depends more on their wealth and business ability than on any conjoint action in this country. Security for sufficient supplies of beef at reasonable prices depends on the maintenance of the British companies operating in South America and on their release from their present dependence on the moderation of the American companies. For thirteen years the latter have pursued a steady policy, sometimes in coöperation, at other times in apparent independence, of reducing the share of the River Plate trade held by the British companies. There is no sign that that policy has come to an end. On the contrary, it appears to be still in full activity; and while the consumer may temporarily profit during the periods of destructive competition, we are not aware of any case in which after competitors have been eliminated the victors have not more than compensated themselves for their campaign losses."[15] The same Committee, reporting a year later on bacon, stated that "it was not denied that the Big Five could, if they combined, control the trade, but the witnesses maintained that the facts within their knowledge disproved the existence of

[15] *Interim Report on Meat Prepared by a Sub-Committee Appointed by the Standing Committee on Trusts* (1920), Cd. 1057, p. 7.

any such endeavor." They also concluded that "the evidence given us tends to show that free competition for the export trade to this country rules both between the 'Big Five' and the 'independents,' and between the firms composing the 'Big Five' there was no sign of any common action between the agents of the American packers in the United Kingdom."[16] Thus the uneasiness regarding the American packers seems to be subsiding, for a time at least, in Britain. The report of the Royal Commission on Food Prices in 1925 refers to the findings of earlier investigation and seems to rely on the British interests led by Lord Vestey to save Britain from any serious danger.[17]

BRITISH COMBINATIONS

The British have had their own large combinations in the meat trades. Some of these are strictly British and some colonial in their origin. Many of the leaders of such concerns are now united in the Vestey interests which constitute a world-wide combination reaching from the ranch to the consumer. This combination now controls nearly a third of the cold storage space and about 2,400 retail meat stores in the Kingdom, many of the large British importing concerns and refrigerating and slaughtering plants in South America, Australia, New Zealand, China and Madagascar, and had works in Russia before the war. Until recently it also owned a fleet of refrigerated steamers over which it still has control. This combination has more branches of the industry under one management than do the packers, for it retails meat on a large scale, partially controls its shipping space and even has considerable ranching property. The British authorities express no

[16] *Final Report*, 1921, of above Committee, Cd. 1356, p. 8.

[17] *First Report of the Royal Commission on Food Prices* (1925), Cd. 2390, Vol. I; *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries, 1925, pp. 48-51.

alarm over the situation but seem rather to welcome powerful home competition against the American packers. The chief fear seems to be a possible danger of alliance between the two interests.[18]

COÖPERATIVE ENTERPRISES

Combinations of farmers operating as coöperative societies exercise no little influence in the live-stock and meat trades in some countries. In no case have any such ventures as yet reached proportions nor taken such form as to engender any fear of so-called trust methods. Denmark is more affected by such organizations than any other country, but the various local concerns have failed so far to come together in any centralized selling scheme. They base their success on service and quality of product rather than any attempt to control the market through concerted action. They have achieved a very large measure of success for this industry.[19] New Zealand also has had a considerable development of coöperative marketing concerns in the mutton and lamb trade. Farmer coöperation in the marketing of live stock to be slaughtered by private enterprises has assumed a considerable importance in the United States and Canada.[20]

Consumers' coöperative societies have taken an important place in the distribution of meat in the British Isles and on the Continent. The British wholesale so-

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[18] *Interim Report on Meat Prepared by a Sub-Committee Appointed by the Standing Committee on Trusts* (1920), Cd. 1057, p. 8, and Departmental Committee on Distribution and Prices of Agricultural Produce, *Interim Report on Meat, Poultry and Eggs* (1923), Cd. 1927, p. 100.

[19] L. Christensen, *Agricultural Coöperation in Denmark*, U. S. Department of Agriculture, Bulletin No. 1266 (1924).

[20] R. H. Ellsworth, *Livestock Marketing Associations in the U. S.* (1924), Preliminary Report, U. S. Department of Agriculture, Bureau of Agricultural Economics; United Livestock Growers Limited, *Report to the Saskatchewan Livestock Pool Investigational Board*, 1925.

cieties deal directly with Danish producers' coöperatives and with other importing agencies. To a limited extent they are engaged in international operations themselves and also in production in other countries. Their operations are so important in Scotland that a combination in the regular trade has been formed to fight them, with no permanent success. In Switzerland, coöperative societies have taken a large part themselves in destroying combinations in the private trade that were supposed to be acting against the public interest.[21]

GOVERNMENT CONTROL BOARDS

Combination, or the equivalent, in the export market has been attempted recently by the government of New Zealand. This government has vested control over the export trade in a Meat Producers' Board. Fortunately for all concerned, this Board has devoted its energies to constructive measures, such as improvements in grading and equalizing the shipment of supplies to the foreign market so as to prevent gluts and scarcities. It has been given power, however, to take as much control as it thinks fit over the marketing of New Zealand meat. The Australian Meat Council is not a marketing agency, but it aims at collective action in securing the improvement of the livestock industry and marketing conditions. In the Argentine the government has recently made an abortive attempt to control prices in the interest of the producers,[22] and this policy has been very seriously proposed in Congress in the United States.

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[21] Sonnichsen, *Consumers' Coöperation*, pp. 85-106.

[22] *First Report of the Royal Commission on Food Prices* (1925), Cd. 2390. *Report on the Trade in Refrigerated Beef, Mutton and Lamb*, Ministry of Agriculture and Fisheries, 1925, pp. 48-51.

THE PLACE OF BIG BUSINESS IN MEAT MARKETING

Large-scale operation in the preparation of meat and in its marketing have been an essential accompaniment of the geographical specialization of production and will probably continue with such specialization. Much has been made of the necessity for large concerns in order to secure the economy in slaughtering and other plant operations, particularly for the utilization of all manner of by-products. This factor would not require very large concerns with chains of plants scattered all over the country. In fact, the packers scatter their physical slaughtering operations in many moderate-sized plants. The greatest reason for large combinations in the industry does not lie in this direction; individual plants the size of single packing-house units can utilize the by-products efficiently or find a market for them in their unfinished state. The real reason for big business lies in the task of nation-wide, or still larger scale, distribution. The supplying of meats when, how and in what range of quality they are called for on many diverse and scattered markets from the distant sources of production is a very complex process and requires the intelligent direction of highly organized and centralized management. That the American packers have such efficient management is proved by the complaints of their critics who fear their competition.[23] The chief economic danger lies in a possible lapse into carelessness if any single interest or community of interests gains control over too large a share of the field. Another economic danger lies in the possibility that ambition of the leaders of such combinations may build up the scale of their operations to a size where inefficiency enters. Such in-

[23] L. H. Haney, *The Case Against the Meat Packers as Seen by the Wholesale Grocers of the South.*

efficiency may be inherent in too large business units or it may be due to limitations in managerial skill or in the development of managerial technique. What may come from improvements of the latter in the future is an open question. At present it appears that, while efficiency and profit increase with the size of the business up to a certain point, they decrease again in marketing operations when ambition leads into too extensive operations. If combinations maintain themselves in careless management or in uneconomically large business units through the power of their accumulated wealth and by means of unfair trade practices, economic harm is accomplished. On the other hand, if actual and potential competition is met only by fair economic means and the "best man" is allowed to win in the struggle for business, the best economic interests of both producers and consumers will be served and operations will be conducted on the scale in which they are most efficient. Competition should not be considered an end in itself. Too much competition is uneconomic and can only be temporary, for it soon weeds out the weaker competitors and leads to at least a temporary approach to monopoly. Relative stability of the packing industry is more in the interests of both producers and consumers than is such sporadic cut-throat competition. The degree of competition that exists in the industry is better than either extreme; it not only insures the lowest possible spread between live-stock prices and wholesale meat prices, but it is most likely to give competition in service with resulting economy and efficiency of operation. Two things are vitally needed: knowledge as to the size and scope of operations which give the most efficient operation and protection of actual and potential competing enterprises from the possible destructive force of the accumulated wealth of the established concerns. It would seem from recent government reports on the industry that this degree or

type of competition exists. There also is increasing evidence being collected by different research agencies as to what constitutes the most efficient size of units of various types of business.

Competition from different types of enterprise is also exceedingly beneficial from various points of view. One difficulty with business combination is the popular jealousy and distrust which it engenders. If producers and consumers develop competing enterprises on the coöperative basis, they learn the true facts regarding the difficulties and the profits of the business, and the knowledge that if they take the trouble, they can be independent of the "trusts," goes a long way toward allaying popular suspicion. Such developments are also an actual insurance against undue business profits, if such develop. Of much more importance is the fact that they vigorously introduce angles of interest into marketing operations that may be neglected by the regular trade. The competition of such irregulars leads to general adoption of any good innovations which they may develop. This type of marketing enterprise does not seem likely to expand to the point where it will drive out private business.

At present it would appear that the world's leading meat markets were fairly well supplied not only with efficient large-scale business enterprises, but with sufficient actual competitors to insure a relatively efficient marketing service and freedom from the danger of undue domination by selfish business interests.

CHAPTER XVI

INTERNATIONAL TRADE

THE international trade in meats, fats and meat-producing animals is an important part of world commerce, although its importance is small when compared with the output of that part of the industry which never goes beyond national boundaries. It is impossible to determine the total production of meat in all the countries small and large in the whole world. There are many lands where the amount of meat used is not known and which contribute practically nothing to international trade. While the per capita consumption may be lower there than in some other countries, the total amount used in these countries of less prominence in the industry makes a large quantity. In the countries where the facts regarding the meat industry are better known and which enter into the world trade in these products the domestic trade is also very large and, with but two exceptions, greater than the foreign trade. Nevertheless, the international trade in meats amounts to very large proportions and takes a position of prominence among the various branches of world commerce. In the average year just before the war the leading countries exported about 4,390,000,000 pounds of meats and animal fats besides 2,119,000 meat-producing animals. In the average year at the first of this decade these same countries exported 5,801,000,000 pounds of dressed products and 1,643,000 live animals.[1]

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[1] See page 577 *infra*.

THE LEADING NATIONS IN INTERNATIONAL TRADE

Great Britain is the central figure in the world's meat trade as an importer and the United States until the year 1924 took the leading place in the export trade. The United Kingdom has always been the chief purchaser of foreign meats and the political separation of the Irish Free State, which has always produced a surplus of meat and live stock for the markets of Great Britain, tends to swell her import figures. In the average pre-war year the United Kingdom took 2,814,000,000 pounds out of the total exports of 4,390,000,000 from the leading nations. Recently she has taken 3,606,000,000 pounds out of 5,801,000,000. The United States has, at least temporarily, lost her position as the leading exporter of meats. Her average exports for the three years ending in 1923, however, still gave her the leading position, a position which was due to the export of pork products and beef fats rather than red meats. The Argentine, with an average export of 1,528,000,000 pounds in the same years, was the sole close competitor among the world exporters, and the only other country which passed the billion pound mark. These two nations together supplied about 60 per cent of the export trade of the leading nations in those years. During the years 1924 and 1925 the Argentine has surpassed the United States in exports, due at once to the decline of the trade of the one and the expansion of that of the other.

These three nations hold the place of major importance in world trade. New Zealand, Uruguay, Australia, Denmark, Brazil and Canada also take prominent places as surplus-producers. Just before the war Canada was a net importer of some kinds of meat and in danger of losing her surplus of meat as a whole commodity class. Her place in the surplus group is unquestionable now. The

Union of South Africa was in the surplus-producing group during the war with a net export of over a million pounds in each of two years. Recently she has returned to the deficiency group, although her imports are not nearly so large as in the pre-war years. China is distinctly a net exporter of meat and so also are French Indo-China, Madagascar and, to a limited extent, many parts of Africa and South America. Cuba, the Philippines and many of the smaller countries, on the other hand, import more than they export.

Among the European nations the only surplus-producer of importance is Denmark, which consistently exports large quantities of pork products. Sweden also was, and is, distinctly on the net export basis, but her exports are not very large. The statistics indicate that the Netherlands exported slightly more than was imported just before the war. The oleomargarine trade was partially responsible for the large trade figures of this country, but her export of pork products, as well as of live hogs, exceeds the import in recent years, as it did before the war. Taking all meats and animal fats together, however, the recent imports of the Netherlands have been greater than the exports. The United Kingdom and Germany are the leading import nations. There is no question as to their deficit and its importance. The break-up of the old Austro-Hungarian Empire made Austria a deficiency nation and Czecho-Slovakia has recently been importing almost as heavily, while Hungary produces a small surplus even in the present conditions. Belgium, Italy, Switzerland, Norway and Spain also import more than they export, while France has given up her pre-war position of virtual independence of foreign supplies and is now a heavy net importer. Russia formerly imported large quantities from her Asiatic domain and China. Apparently a little of this trade remains.

The following tables draw together the statistics of greatest importance for the industry in each of the leading twenty-four nations.[2] They show the number of animals and foreign trade of each country before the war and within recent years and the amount and per capita rate of consumption in each country in 1923 or the nearest year for which data are available. In a few cases it has been impossible to get the various data for the particular years indicated in the table headings and figures have been given for the nearest available period. It also is impossible in the case of most countries to distinguish completely between beef, mutton and pork products. Accordingly, the summary table contains more products than are counted in the three other tables combined. The cattle and beef data include all that clearly belong under that heading, with some data that cover a minor proportion of other meats. Similarly the tables on mutton and pork include only those data which can be classified to a reasonable degree of certainty. Such items as "canned meats" and tallow cannot be classified and appear only in the summary table which covers, as far as possible, all edible meats and animal fats.

It may be said by way of a brief survey of world conditions that the chief import trade centers are Great Britain and the other industrial countries of Europe. In addition there is a regional trade of fair proportions in Latin America in jerked beef. Cuba is now the focus of this trade which comes from other Latin American countries. She also takes considerable pork from the United States. Another trade center appears in the Far East in

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[2] The data on live-stock population are derived mainly from the *International Yearbook of Agricultural Statistics*, 1924-25. The data on imports and exports of dressed products are derived from J. E. Wrenn, *International Trade in Meats and Animal Fats*, U. S. Department of Commerce, Trade Promotion Series, No. 26. The data on shipments of live stock are derived from the original import and export statistics of the various countries.

the Philippines and other sections where American and European influence predominates. The origin of this trade is largely Oriental. It must also be noted particularly that most of the countries in the world trade in meats are at one and the same time importers and exporters. This is due partially to local trade at the borders and to differences in the seasons of production in various countries. The outstanding reason, however, is the fact that the types of product most efficiently produced in any one nation may not entirely suit the demands of the consumers in that nation. For that reason Canada exports lean bacon to England and imports a different type of bacon from the United States to fit an important part of the local demand. A number of the European nations also buy fats from the United States and sell lean meats to England.

THE EARLY TRADE IN LIVE STOCK

The international trade in animals and meats has become important only within this last century. There has been some trade in live animals in Europe for many centuries. A royal decree in Denmark regulated the export of fat steers in 1457. In the middle ages that country sold fat cattle to Germany and the Netherlands.[3] Live animals continued to be the chief form of this commerce until the middle of the last century and this trade was carried on as a rule only between contiguous countries. In those days epidemics of disease among the live stock were a serious problem, as they are in Africa to-day where there are but few restrictions on the movement of cattle. The continent of Europe was troubled very severely and even Great Britain at times had serious outbreaks of disease. In 1770 she prohibited the import of hides and horns as well as live animals. As a result, disease was comparatively rare until after 1840, when import regulations were re-

[3] Faber, *Coöperation in Danish Agriculture*, p. 85.

STATISTICAL SUMMARY FOR THE LEADING COUNTRIES

All Animals and Meats

Figures (except per capita consumption) in thousands

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Non-European:									
United States	*Live, no.*	*169,187*	*172,890*	*316*	*264*	*270*	*259*	.....	.....
	Dressed, lb.	.....	.....	41,114	49,539	1,204,063	1,925,004	18,478,000	183.4
Canada	*Live, no.*	*12,233*	*16,405*	*119*	*29*	*175*	*374*	.....	.....
	Dressed, lb.	.....	.....	38,032	63,755	59,339	149,719	1,459,778	160.72
Argentina	*Live, no.*	*71,992*	*74,711*	*103*	*34*	*276*	*125*	.....	.....
	Dressed, lb.	.....	.....	2,050	255	1,050,323	1,528,332	1,918,886	220.65
Brazil	*Live, no.*	*59,655*	*58,372*	*116*	*9*	*0*	*13*	.....	.....
	Dressed, lb.	.....	.....	63,271	9,335	2,048	170,752	.....	.....
Uruguay	*Live, no.*	*34,659*	*23,250*	*41*	*14*	*332*	*54*	.....	.....
	Dressed, lb.	.....	.....	76	5	190,698	327,981	.....	.....
Venezuela	*Live, no.*	*3,799*	*3,403*	*0*	*0*	*15*	*28*	.....	.....
	Dressed, lb.	.....	.....	375	1,523	1,724	2,779	.....	.....
Australia	*Live, no.*	*97,341*	*94,365*	*5*	*2*	*33*	*44*	.....	.....
	Dressed, lb.	.....	.....	1,117	131	423,165	262,577	1,275,521	226.51
New Zealand	*Live, no.*	*26,551*	*26,963*	*1*	*1*	*9*	*6*	.....	.....
	Dressed, lb.	.....	.....	522	658	332,459	469,662	336,891	307
British South Africa	*Live, no.*	*42,687*	*41,407*	*5*	*4*	*7*	*8*	.....	.....
	Dressed, lb.	.....	.....	26,621	6,879	1,991	3,220	388,270	55.2
Total Non-European	*Live, no.*	*518,104*	*511,766*	*706*	*357*	*1,117*	*94*	.....	.....
	Dressed, lb.	.....	.....	173,178	132,080	3,265,810	4,840,026	.....	.....
European:									
United Kingdom	*Live, no.*	*42,707*	*40,208*	*175*	*455*	*11*	*9*	.....	.....
	Dressed, lb.	.....	.....	2,814,216	3,606,240	321,722	301,711	6,117,440	127.3
France	*Live, no.*	*39,043*	*29,080*	*1,285*	*1,227*	*124*	*110*	.....	.....
	Dressed, lb.	.....	.....	68,368	266,484	66,622	46,159	4,509,035	115

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Italy	*Live, no.*	*19,870*	*20,381*	*116*	*127*	*70*	*66*	.....	.....
	Dressed, lb.	.....	.....	29,770	78,794	11,189	15,968	1,875,779	48.3
The Netherlands	*Live, no.*	*4,289*	*4,249*	*11*	*0*	*298*	*113*	.....	.....
	Dressed, lb.	.....	.....	301,947	205,977	304,218	163,879	314,211	45.77
Belgium	*Live, no.*	*3,446*	*2,905*	*234*	*78*	*1*	*6*	.....	.....
	Dressed, lb.	.....	.....	45,050	171,958	17,918	20,597	609,732	79.54
Germany	*Live, no.*	*45,997*	*40,104*	*352*	*113*	*47*	*21*	.....	.....
	Dressed, lb.	.....	.....	426,215	489,208	4,602	2,186	5,687,374	94.79
Switzerland	*Live, no.*	*2,174*	*2,310*	*264*	*53*	*23*	*10*	.....	.....
	Dressed, lb.	.....	.....	43,379	38,316	1,928	1,926	281,340	75.0
Austria	*Live, no.*	*4,589*	*4,232*		*256*		*21*	.....	.....
	Dressed, lb.	.....	.....		129,855		6,114	516,606	79
Hungary	*Live, no.*	*7,778*	*5,539*	*75*	*9*	*104*	*156*	.....	.....
	Dressed, lb.	.....	.....	17,441	11,094	10,132	15,424	.....	.....
Czecho-Slovakia	*Live, no.*		*7,435*		*248*		*13*	.....	.....
	Dressed, lb.	.....	.....		108,321		1,175	.....	.....
Russia	*Live, no.*	*84,705*	*66,945*	*0*	*139*	.....	.....	.....	.....
	Dressed, lb.	.....	.....	127,047	8,750	33,713	.....	4,697,914	34.1
Denmark	*Live, no.*	*5,478*	*5,750*	*24*	*1*	*145*	*177*	.....	.....
	Dressed, lb.	.....	.....	39,985	20,044	322,804	336,161	410,477	125.16
Norway	*Live, no.*	*2,866*	*2,893*	*17*	*16*	*	*	.....	.....
	Dressed, lb.	.....	.....	39,645	70,882	2,619	1,973	178,640	64.94
Sweden	*Live, no.*	*4,673*	*5,315*	*3*	*269*	*45*	*25*	.....	.....
	Dressed, lb.	.....	.....	17,457	33,849	26,265	46,424	.....	.....
Spain	*Live, no.*	*22,030*	*26,903*	*303*	*10*	*134*	*5*	.....	.....
	Dressed, lb.	.....	.....	32,877	14,873	733	1,369	1,354,364	63
Total European	*Live, no.*	*289,645*	*264,249*	*2,859*	*3,001*	*1,002*	*732*	.....	.....
	Dressed, lb.	.....	.....	4,003,397	5,254,645	1,124,465	961,066	.....	.....
Total All Countries	*Live, no.*	*807,749*	*776,015*	*3,565*	*3,358*	*2,119*	*1,643*	.....	.....
	Dressed, lb.	.....	.....	4,176,575	5,386,725	4,390,275	5,801,092	.....	.....

* Less than 1,000.

STATISTICAL SUMMARY FOR THE LEADING COUNTRIES

Cattle and Beef

Figures (except per capita consumption) in thousands

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Non-European:									
United States	*Live, no.*	*56,527*	*67,240*	*252*	*191*	*125*	*114*	.....	.....
	Dressed, lb.	.....	.....	36,027	24,718	186,879	131,623	7,791,000	70.4
Canada	*Live, no.*	*6,656*	*9,246*	*4*	*3*	*110*	*251*	.....	.....
	Dressed, lb.	.....	.....	2,485	819	3,589	26,043	640,778	70.55
Argentina	*Live, no.*	*25,867*	*37,065*	*25*	*11*	*179*	*69*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	686,071	1,008,601	1,799,048	206.87
Brazil	*Live, no.*	*30,705*	*34,271*	*55*	*7*	*	*7*	.....	.....
	Dressed, lb.	.....	.....	59,492	9,265	1,562	139,914	.....	.....
Uruguay	*Live, no.*	*8,193*	*8,432*	*29*	*6*	*115*	*31*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	149,354	271,327	.....	.....
Venezuela	*Live, no.*	*2,004*	*2,778*	*0*	*0*	*15*	*20*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	1,724	2,746	.....	.....
Australia	*Live, no.*	*11,484*	*13,358*	*0*	*1*	*9*	*9*		
	Dressed, lb.	.....	.....	12	16	130,097	152,253	809,130	143.7
New Zealand	*Live, no.*	*2,020*	*3,481*	*	*0*	*	*2*	.....	.....
	Dressed, lb.	.....	.....	378	411	41,240	82,057	186,542	169.5
British South Africa	*Live, no.*	*5,797*	*9,315*	*1*	*6*	*	*1*	.....	.....
	Dressed, lb.	.....	.....	6,451	4	145	1,969	260,577	31.3
Total Non-European	*Live, no.*	*149,253*	*185,186*	*366*	*225*	*553*	*504*	.....	.....
	Dressed, lb.	.....	.....	104,845	35,233	1,200,661	1,816,533	.....	.....
European:									
United Kingdom	*Live, no.*	*11,861*	*11,979*	*161*	*234*	*5*	*5*	.....	.....
	Dressed, lb.	.....	.....	923,444	1,434,799	19,492	100,327	3,046,400	63.4
France	*Live, no.*	*15,338*	*13,749*	*30*	*82*	*112*	*43*	.....	.....
	Dressed, lb.	.....	.....	4,485	107,418	8,099	44,637	2,344,698	59.8

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Italy	*Live, no.*	*6,199*	*6,239*	*102*	*111*	*22*	*6*	.....	.....
	Dressed, lb	.....	.....	15,208	57,692	2,603	8,004	1,021,387	26.3
The Netherlands	*Live, no.*	*2,097*	*2,062*	*1*	*	*75*	*57*	.....	.....
	Dressed, lb.	.....	.....	2,105	52,575	34,187	19,166	.....	.....
Belgium	*Live, no.*	*1,849*	*1,603*	*67*	*45*	*	*3*	.....	.....
	Dressed, lb	.....	.....	1,053	98,329	271	3,899	218,287	28.47
Germany	*Live, no.*	*18,475*	*16,691*	*218*	*82*	*4*	*5*	.....	.....
	Dressed, lb.	.....	.....	53,389	121,480	214	1,881	2,142,148	35.7
Switzerland	*Live, no.*	*1,443*	*1,425*	*86*	*18*	*20*	*9*	.....	.....
	Dressed, lb.	.....	.....	17,655	8,000	1,134	96	.....	.....
Austria	*Live, no.*	*2,352*	*2,162*		*118*		*12*	.....	.....
	Dressed, lb.	.....	.....		31,697		7,264	.....	.....
Hungary	*Live, no.*	*2,150*	*1,819*	*62*	*7*	*76*	*75*	.....	.....
	Dressed, lb.	.....	.....	2,832	143	1,056	14,199	.....	.....
Czecho-Slovakia	*Live, no.*		*4,391*		*73*		*9*	.....	.....
	Dressed, lb.	.....	.....		228		762	.....	.....
Russia	*Live, no.*	*30,736*	*27,747*	*0*	.....	*4*	.....	.....	.....
	Dressed, lb.	.....	.....	25,080	5,959	6,017	.....	2,016,403	14.6
Denmark	*Live, no.*	*2,254*	*2,523*	*14*	*	*139*	*115*	.....	.....
	Dressed, lb.	.....	.....	11,754	2,907	39,959	30,303	188,824	57.58
Norway	*Live, no.*	*1,134*	*1,131*	*15*	*12*	*	*0*	.....	.....
	Dressed, lb.	.....	.....	11,857	27,968	531	519	88,499	32.18
Sweden	*Live, no.*	*2,723*	*2,736*	*2*	*3*	*34*	*12*	.....	.....
	Dressed, lb.	.....	.....	1,434	5,942	10,886	13,779	.....	.....
Spain	*Live, no.*	*2,879*	*3,297*	*15*	*8*	*49*	*	.....	.....
	Dressed, lb.	.....	.....	1,130	1,108	7	263	360,893	16.8
Total European	*Live, no.*	*101,490*	*99,554*	*773*	*793*	*540*	*351*	.....	.....
	Dressed, lb.	.....	.....	1,071,426	1,956,245	124,436	245,099	.....	.....
Total All Countries	*Live, no.*	*250,743*	*284,740*	*1,139*	*1,018*	*1,093*	*855*	.....	.....
	Dressed, lb.	.....	.....	1,176,271	1,991,478	1,325,097	2,061,632	.....	.....

* Less than 1,000.

STATISTICAL SUMMARY FOR THE LEADING COUNTRIES

Swine and Pork Products

Figures (except per capita consumption) in thousands

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Non-European:									
United States	*Live, no.*	*61,178*	*68,427*	*0*	*0*	*13*	*93*	.....	.....
	Dressed, lb.	.....	.....	1,327	2,534	921,740	1,716,157	10,113,000	107.8
Canada	*Live, no.*	*3,448*	*4,405*	*0*	*8*	*1*	*2*	.....	.....
	Dressed, lb.	.....	.....	26,683	56,071	48,216	108,066	740,389	81.52
Argentina	*Live, no.*	*2,900*	*1,437*	*	*	*	*	.....	.....
	Dressed, lb.	.....	.....	1,637	57	17	12,783	61,832	7.11
Brazil	*Live, no.*	*18,400*	*16,168*	*	*	*	*2*	.....	.....
	Dressed, lb.	.....	.....	3,779	70	340	15,978	.....	.....
Uruguay	*Live, no.*	*180*	*304*	*	*	*	*	.....	.....
	Dressed, lb.	.....	.....	76	16	5	530	.....	.....
Venezuela	*Live, no.*	*1,618*	*512*	*0*	*0*	*	*8*	.....	.....
	Dressed, lb.	.....	.....	1,739	1,517	.....	.....	.....	.....
Australia	*Live, no.*	*800*	*897*	*	*0*	*	*	.....	.....
	Dressed, lb.	.....	.....	798	100	5,348	6,084	61,018†	10.8†
New Zealand	*Live, no.*	*349*	*401*	*	*	*	*	.....	.....
	Dressed, lb.	.....	.....	144	114	1,114	2,419	29,995	27.5
British South Africa	*Live, no.*	*1,082*	*868*	*	*	*2*	*1*	.....	.....
	Dressed, lb.	.....	.....	8,262	904	19	484	7,892†	1.1†
Total Non-European	*Live, no.*	*89,955*	*93,419*	*0*	*8*	*16*	*106*	.....	.....
	Dressed, lb.	.....	.....	44,445	61,383	976,799	1,862,501	.....	.....
European:									
United Kingdom	*Live, no.*	*3,294*	*4,149*	*0*	*93*	*	*1*	.....	.....
	Dressed, lb.	.....	.....	826,627	1,254,617	54,012	148,355	2,007,040	41.8
France	*Live, no.*	*7,529*	*5,406*	*143*	*131*	*68*	*60*	.....	.....
	Dressed, lb.	.....	.....	32,283	107,820	8,556	7,575	1,803,614	46.0

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Italy	*Live, no.*	*2,508*	*2,389*	*10*	*2*	*19*	*51*	.....	.....
	Dressed, lb.	.....	.....	13,810	18,850	1,428	2,743	710,699	18.3
The Netherlands	*Live, no.*	*1,350*	*1,519*	*6*	*	*125*	*101*	.....	.....
	Dressed, lb.	.....	.....	72,815	33,367	127,111	119,116	.....	.....
Belgium	*Live, no.*	*1,412*	*1,176*	*	*12*	*	*1*	.....	.....
	Dressed, lb.	.....	.....	19,220	42,662	13,984	13,475	237,677	31.0
Germany	*Live, no.*	*22,534*	*17,308*	*123*	*126*	*12*	*14*	.....	.....
	Dressed, lb.	.....	.....	236,740	366,581	3,484	603	3,040,816	50.68
Switzerland	*Live, no.*	*570*	*640*	*115*	*16*	*	*	.....	.....
	Dressed, lb.	.....	.....	18,389	18,698	126	401	.....	.....
Austria	*Live, no.*	*1,930*	*1,473*		*130*		*5*	.....	.....
	Dressed, lb.	.....	.....		76,441		617	.....	.....
Hungary	*Live, no.*	*3,222*	*2,133*	*3*	*	*2*	*61*	.....	.....
	Dressed, lb.	.....	.....	8,843	7,840	3,034	757	.....	.....
Czecho-Slovakia	*Live, no.*		*2,058*		*172*		*	.....	.....
	Dressed, lb.	.....	.....		57,168		501	.....	.....
Russia	*Live, no.*	*11,569*	*6,722*	*0*	.....	*94*	.....	.....	.....
	Dressed, lb.	.....	.....	.....	5,942	24,800	.....	1,668,050	12.1
Denmark	*Live, no.*	*2,497*	*2,853*	*6*	*	*0*	*61*	.....	.....
	Dressed, lb.	.....	.....	12,663	8,700	326,401	298,533	126,809	38.67
Norway	*Live, no.*	*334*	*237*	*	*	*	*	.....	.....
	Dressed, lb.	.....	.....	9,255	21,784	1,859	196	49,150	17.87
Sweden	*Live, no.*	*978*	*1,011*	*	*266*	*9*	*10*	.....	.....
	Dressed, lb.	.....	.....	6,064	18,653	13,956	30,160	140,369	23.4
Spain	*Live, no.*	*2,710*	*4,229*	*33*	*	*36*	*2*	.....	.....
	Dressed, lb.	.....	.....	733	2,381	726	1,106	568,485	26.4
Total European	*Live, no.*	*62,437*	*53,303*	*439*	*948*	*365*	*367*	.....	.....
	Dressed, lb.	.....	.....	1,257,442	2,041,504	579,477	624,138	.....	.....
Total All Countries	*Live, no.*	*152,392*	*146,722*	*439*	*956*	*381*	*473*	.....	.....
	Dressed, lb.	.....	.....	1,301,887	2,102,887	1,556,276	2,486,639	.....	.....

* Less than 1,000. † Bacon and ham only.

STATISTICAL SUMMARY FOR THE LEADING COUNTRIES

Sheep and Mutton

Figures (except per capita consumption) in thousands

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Non-European:									
United States	*Live, no.*	*51,482*	*37,223*	*64*	*73*	*131*	*50*	.....	.....
	Dressed, lb.	.....	.....	2,542	6,512	3,539	1,842	574,000	5.2
Canada	*Live, no.*	*2,129*	*2,754*	*115*	*18*	*63*	*121*	.....	.....
	Dressed, lb.	.....	.....	4,003	3,146	50	4,407	78,611	8.65
Argentina	*Live, no.*	*43,225*	*36,209*	*78*	*24*	*97*	*56*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	151,507	168,002	58,006	6.67
Brazil	*Live, no.*	*10,550*	*7,933*	*61*	*2*	*	*4*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	.....	.....
Uruguay	*Live, no.*	*26,286*	*14,514*	*12*	*8*	*216*	*23*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	5,497	23,457	.....	.....
Venezuela	*Live, no.*	*177*	*113*	*0*	*0*	*	*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	.....	.....
Australia	*Live, no.*	*85,057*	*80,110*	*4*	*	*24*	*35*	.....	.....
	Dressed, lb.	.....	.....	5	2	151,404	104,741	405,373	71.99
New Zealand	*Live, no.*	*24,182*	*23,081*	*	*	*8*	*4*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	232,163	319,806	120,353	121
British South Africa	*Live, no.*	*35,808*	*31,224*	*4*	*17*	*5*	*5*	.....	.....
	Dressed, lb.	.....	.....	2,785	95	45	330	159,466	22.8
Total Non-European	*Live, no.*	*278,896*	*233,161*	*338*	*142*	*544*	*298*	.....	.....
	Dressed, lb	.....	.....	9,335	9,775	544,205	622,585	.....	.....
European:									
United Kingdom	*Live, no.*	*27,552*	*24,080*	*14*	*129*	*6*	*3*	.....	.....
	Dressed, lb.	.....	.....	593,119	709,094	1,594	7,634	1,061,760	22.1
France	*Live, no.*	*16,176*	*9,925*	*1,112*	*1,114*	*44*	*8*	.....	.....
	Dressed, lb.	.....	.....	635	19,359	315	627	360,723	9.2

Country		Number of Animals		Imports		Exports		Consumption	
		1913	1923	Pre-war	Recent	Pre-war	Recent	Total	Per Capita
Italy	*Live, no.*	*11,163*	*11,753*	*4*	*14*	*29*	*8*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	143,693	3.7
The Netherlands	*Live, no.*	*842*	*668*	*3*	*	*98*	*55*	.....	.....
	Dressed, lb.	.....	.....	50	95	19,393	13,178	.....	.....
Belgium	*Live, no.*	*185*	*126*	*167*	*21*	*	*1*	.....	.....
	Dressed, lb.	.....	.....	6	2,736	85	479	5,418	.71
Germany	*Live, no.*	*4,988*	*6,105*	*11*	*4*	*30*	*3*	.....	.....
	Dressed, lb.	.....	.....	874	2,914	.....	.....	138,470	2.3
Switzerland	*Live, no.*	*161*	*245*	*63*	*19*	*3*	*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	.....	.....
Austria	*Live, no.*	*307*	*597*		*9*		*5*	.....	.....
	Dressed, lb.	.....	.....		2,912		772	.....	.....
Hungary	*Live, no.*	*2,406*	*1,587*	*9*	*1*	*26*	*20*	.....	.....
	Dressed, lb.	.....	.....	118	.....	1,366	.....	.....	.....
Czecho-Slovakia	*Live, no.*		*986*		*3*		*4*	.....	.....
	Dressed, lb.	.....	.....		4		302	.....	.....
Russia	*Live, no.*	*42,400*	*32,476*	.....	.....	*41*	.....	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	1,013,361	7.4
Denmark	*Live, no.*	*727*	*374*	*	*	*6*	*	.....	.....
	Dressed, lb.	.....	.....	5,037	1,670	2,282	817	19,183	5.85
Norway	*Live, no.*	*1,398*	*1,525*	*2*	*4*	*	*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	18,286	6.64
Sweden	*Live, no.*	*972*	*1,568*	*	*2*	*2*	*2*	.....	.....
	Dressed, lb.	.....	.....	1,292	634	85	479	.....	.....
Spain	*Live, no.*	*16,441*	*19,377*	*255*	*	*49*	*4*	.....	.....
	Dressed, lb.	.....	.....	.....	.....	.....	.....	189,696	8.8
Total European	*Live, no.*	*125,718*	*111,392*	*1,638*	*1,320*	*334*	*113*	.....	.....
	Dressed, lb.	.....	.....	601,131	739,418	25,120	24,288	.....	.....
Total All Countries	*Live, no.*	*404,614*	*344,553*	*1,976*	*1,462*	*878*	*411*	.....	.....
	Dressed, lb.	.....	.....	610,466	749,173	569,325	646,873	.....	.....

* Less than 1,000.

laxed. For the next half-century Britain imported large numbers of live stock from her European neighbors and the Americas. Contagious diseases reappeared and did great damage. The country was constantly troubled with pleuro-pneumonia and foot-and-mouth disease and in 1865 rinderpest was introduced and caused great losses. In 1892, the import of animals from most of the European countries was prohibited as a health measure, but supplies from North America were allowed to go forward to be turned among the British animals in the fattening pastures. In 1896, the law was made more stringent and thenceforth until 1922 animals imported alive were required to be slaughtered at the ports within ten days of landing. Cattle continued to go forward in large numbers from North America for slaughtering at the ports, until about 1912, at which date this trade practically disappeared.[4] Within the last few years Canadian cattle have gone forward principally for the store trade.

The trade in live animals is feasible only when the health of the herds in the exporting countries is peculiarly good. There are many lands whose stock is not fit to be brought into contact with the animals of other nations. Another serious obstacle besides disease is the effect of the hardships of transportation on the animals shipped. Humanitarian arguments have been raised against the trade, but the economic arguments have proved far weightier. Losses through injury and death during shipment are frequently heavy, but the greatest loss comes through shrinkage in weight and deterioration in condition that almost certainly accompany long shipments especially at sea. Transportation costs are also heavier for live stock than for the dressed meat from the same number of animals.

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[4] Critchell and Raymond, *A History of the Frozen Meat Trade*, pp. 75, 403-410.

Half a century ago, the import of meat into Great Britain, which was the chief market, was in the form of live stock, mainly from the continent of Europe. In cattle the Netherlands took the lead, with an annual average of 73,428, followed by Germany with 60,691, Spain with 19,774, Denmark with 19,514, Portugal with 18,370 and Norway and Sweden together with 8,841. From then on the imports from Germany and the Netherlands fell off, while those from Spain increased slightly; those from Portugal fluctuated until about 1884, when they decreased markedly; those from Sweden and Norway increased decidedly in the eighties and disappeared in the next decade; and those from Denmark increased greatly to the maximum of 119,841 in the year 1883, after which they declined and in turn disappeared in the nineties. All imports from the Continent were stopped in the nineties; disease was prevalent and imports were prohibited. Importation from North America began in 1873 both from Canada and the United States. Canada made the more vigorous start, but in 1877 the United States' shipments shot ahead to 11,524 and from then on increased, reaching the maximum of 416,299 in 1897, after which they declined gradually until they finally almost disappeared in 1912. Canadian exports gradually increased on the average until 1906, after which they followed the decline of the trade from the United States. Argentinian cattle also appeared on the British market in the nineties and again in 1900 and 1903; the maximum movement was 89,369 head in 1898.[5]

Sheep were imported heavily by Great Britain half a century ago from Germany, the Netherlands and Belgium. How much of the trade credited to the latter two countries originated in Germany is hard to determine. The high points in imports from Germany came in 1872, with 571,-

[5] *Minutes of Evidence Taken before the Departmental Committee on Combinations in the Meat Trade* (1909), Cd. 4661, p. 229.

854 head and 1884 with 501,509 head, the trade expanding on the average until the middle of the eighties and disappearing entirely in the next decade. The imports from the Netherlands reached their high point in 1887, with 501,701 head and disappeared after 1892. Belgian supplies disappeared in 1887, having reached their peak in 1876 with 253,292 head. Sweden and Norway were also contributors until 1896. Denmark, with Iceland and Greenland, has continued to contribute since 1870, the highest point having been reached in 1889 with 153,362 head. Of late years this trade is only from Iceland and Greenland. Trade from North America started in from Canada in 1876 and the United States in the following year. This trade was irregular until 1893 when it stopped entirely from the United States and nearly stopped from Canada. The following year it started in more heavily than ever, reaching the high points of 453,250 from the United States and 214,310 from Canada in 1895. After 1905 this trade was small. Here again there is no certainty as to origin, for probably both Canadian cattle and sheep were shipped to Great Britain through United States ports. The Argentine also appeared as a prominent source in the nineties, reaching the figure of 430,073 in 1898.[6]

Swine were imported by Great Britain to a certain extent from the Continent half a century ago, but this trade disappeared entirely in 1892. Holland was the heaviest shipper and her trade lasted to the latest date. In 1870 she shipped 43,079 live pigs. Germany shipped as many as 35,580 in 1871, and Denmark, after many ups and downs, shipped 21,013 in 1889, just two years before her trade disappeared. Sweden shipped a few at intervals until 1890 and France shipped fairly heavily until 1879, reaching the high point of 42,599 in 1874. The United States

[6] *Minutes of Evidence Taken before the Department Committee on Combinations in the Meat Trade* (1909), Cd. 4661, p. 230.

and Canada shipped a few at intervals between 1874 and 1898, but this trade was insignificant.[7]

In the third quarter of the last century a considerable quantity of meat got into international trade preserved in pickle and sometimes in tins. This form of trade protected the health of the animals of the importing countries, but in the early days afforded no safeguard for the health of the people that ate it. In those days it was even not generally recognized that animal disease could be communicated to human beings through milk. Fortunately, most of the meat of commerce has always been thoroughly cooked before eating, but the appreciable portion of cured meat consumed raw or without proper cooking was a menace to the health of the people.

THE EARLY TRADE IN CURED MEAT

The surplus beef and pork of the central portion of the United States afforded a considerable supply of cured meats to the British markets in those early decades. This country had had an export trade in cured meats with the West Indies for a couple of centuries. William Pynchon of Springfield, Massachusetts, seems to have been the first packer and exporter of meats in what is now the United States. He was in this business as early as 1662. American beef and pork was on the British market soon after 1840. For a time difficulty was experienced in supplying the quality of meat required, but these obstacles were soon overcome. By 1855 the trade was firmly established. The meat was pickled and then packed with salt in huge casks containing several hundred pounds of meat. This trade assumed fairly large proportions, but failed to solve the problem of getting large surplus production to the markets

[7] *Minutes of Evidence Taken before the Department Committee in the Meat Trade* (1909), Cd. 4661, p. 231.

where it could be freely used.[8] The efforts in tinning meat in Australia for the British market were no more successful.[9]

TRADE IN REFRIGERATED MEAT

The application of artificial refrigeration to the transportation of meat revolutionized international trade. The first meat brought into England under refrigeration was a shipment from the United States in 1874. This shipment was cooled with ice. In this decade various experiments were made with mechanical refrigeration. The Australians, who were at that time boiling down their meat for tallow, were the leaders in these efforts. French and English engineers assisted them in developing the technique of the undertaking. The first shipment of meat across the tropics to Europe was in 1877. This was in a French ship sailing from Buenos Aires to Rouen. The experiment was reasonably successful in that it proved the practicability of transporting meat in such a manner. The French market was unresponsive, however, and it was in the British import trade that refrigerated shipment was really developed to a successful business. The first successful shipment in this trade was received at London in February, 1880, having crossed the equator from Australia with meat frozen hard. From then on the trade grew enormously, frozen meat being shipped from Australasia and South America.[10]

Since freezing meat fails to bring it to the consumer in the best condition, a large quantity is moved under refrigeration without being actually frozen. Mutton and lamb must be frozen hard for shipment over the equator. Beef, however, can be kept just above its freezing point

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[8] Clemen, *American Livestock and Meat Industry*, pp. 23, 114-116.

[9] Critchell and Raymond, *op. cit.*, pp. 7-12.

[10] *Ibid.*, pp. 18-45.

and shipped successfully. North American shipments of fresh beef to Europe have always, except during the war, moved thus as "chilled" beef. It was found impossible at first to ship cargoes for long distances involving a long time in transit without freezing them. Chilled beef molded before it could be transported from the Southern Hemisphere. Improvements in the refrigeration, assuring the continuation of an even temperature, and the introduction of a sterilization process, which destroys the mold spores, have made it practicable to ship chilled beef across the equator. The chilled beef trade from Argentina began at the first of this century and by 1910 more chilled than frozen beef was moved from that country. In 1911, other South American chilled beef appeared on the British market. It has been practically impossible to move chilled beef from Australia and New Zealand to England, and all the supplies from these distant countries are frozen for shipment. During the war the chilled beef trade gave way to frozen shipments to save danger of loss under the abnormal conditions. In 1918 and 1919 practically no chilled supplies arrived in Great Britain, even the North American product being frozen. During these last few years the chilled trade has been revived again and is relatively more important than ever.

Pork products have not until recently been frozen for shipment to any extent. Refrigeration aids in their transportation, for a milder cure can be used when a temperature near the freezing point is used for transportation and storage. Consumers in all the western countries prefer most of their beef and mutton or lamb fresh, but prefer most of their pork cured. The barraled or mess pork of earlier days has lost its importance, however, almost as completely as the cured beef. These old-fashioned products are used to some extent, but their use is eclipsed by that of more appetizing forms of cured meat. The cured pork

of to-day is mostly bacon and ham. These forms of pork and refined lard comprise most of the pork products of world trade. There is also a fairly important trade now in western Europe in refrigerated fresh pork.

The development of refrigeration has solved the problem of getting the meat surplus of the newer countries on to the markets of the older industrialized nations. The meat now reaches the final market almost, if not quite, in as good condition as when it is shipped from the country of origin.

INSPECTION TO PROTECT HEALTH

These developments have done much to save the health of the animals in the importing countries and so, to a certain extent, the health of the human population has benefited indirectly. While these improvements have been in the process of consolidation, other developments have insured the consumers against the danger of the animals being diseased before slaughter in the distant countries. The development of the inspection of live stock before slaughter and the carcasses during preparation for the market has already been discussed. This system of ante- and post-mortem inspection has a peculiar application to international trade. The inspection must necessarily be accomplished in the country of origin and accepted on faith in the consuming nation. It is remarkable to what extent the nations have accepted each other's inspection. Some of the continental nations have required the shipment of certain of the viscera with the carcass for inspection at destination. Some have prohibited shipments of dressed carcasses entirely. However, these instances of apparent lack of faith in the inspection in other countries are usually due more to the desire to protect the domestic producers than to protect the health of the consumers. It is not an unknown thing for the meat pro-

duced at home to be subjected to far less rigorous inspection than the product available in world trade. Most of the nations catering to the international market are now very careful to make certain that nothing but wholesome meat leaves their country. The international competition is so keen that this care has been rendered necessary. This assurance does not exist, unfortunately, in the case of meat originating in the Far East.

THE DEVELOPMENT OF FOREIGN TRADE IN THE LEADING COUNTRIES

The world's trade in the flesh of cattle, sheep and lambs, being predominantly the British import trade until recent years, can best be described by the accompanying charts.[11] These charts portray the British import trade since 1880, distinguishing between mutton and lamb combined and beef, and show the main countries of origin. Beef fats and mutton tallow, which do not appear in the charts, have also moved in large quantity to the Continent as well as to Britain. During the few years since the war an important trade has sprung up in shipments of meats of all kinds to the other nations of western Europe. On this account the charts fail to show the full extent of the recent increases in world shipments. The foregoing tables [12] show the main facts regarding these recent new developments which have sprung out of war-born conditions. Before the war most of the continental nations restricted imports either by the imposition of a tariff or more drastically through provisions making importation more or less impossible on the alleged grounds of public health. There was also a very strong and widespread prejudice

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[11] Based upon statistics in Critchell and Raymond, *op. cit.*, pp. 422, 423, and Weddell and Company's *Annual Review of the Frozen Meat Trade* (1925), Supplement No. 1.

[12] pp. 576-583 *supra.*

against the use of frozen meat. During the war frozen meat was imported and fed to the soldiers. The continental consumers found that it was quite acceptable and the prejudice largely disappeared. At the close of the war the domestic supply of meat was low and the popular

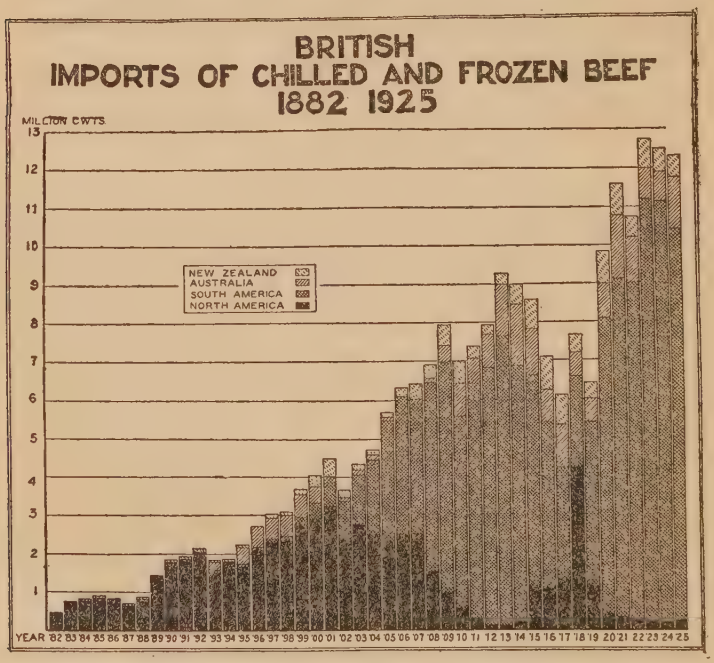

CHART 33.

demand for it was strong, for many men had been supplied regular meat rations in the army who would otherwise never have grown accustomed to its use. Probably also the political influence of the city consumers has been less subordinated to that of the landed interests. Import restrictions have been lightened to reduce the cost of food. The main obstacle to the growth of imports has been the

lack of purchasing ability. This latter factor has depressed the prices at which meat has moved, but the quantities moved have been greatly increased in amount. The Argentine has been the chief source of the supplies of beef for this new continental trade and the United States of pork products. Germany, France and almost all the

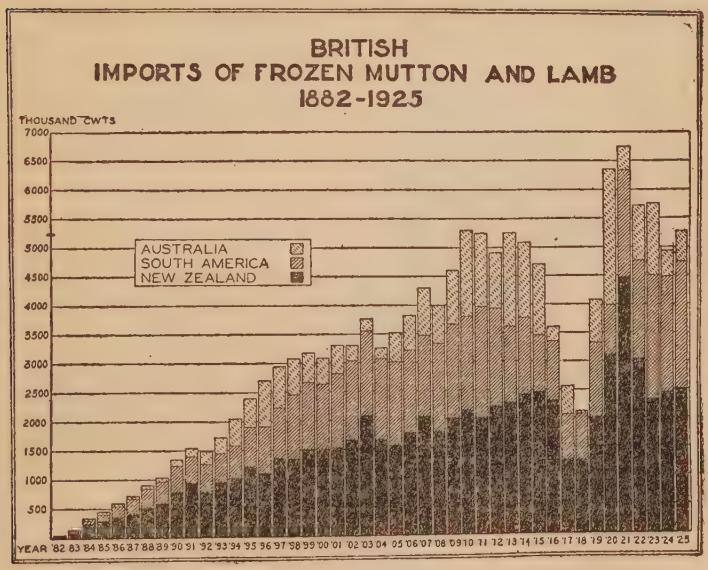

CHART 34.

nations of western Europe have been heavy buyers. A few years ago Britain took practically the whole international trade in frozen and chilled meat. In 1924, the Continent absorbed 459,000 long tons of beef from other parts of the world, a quantity equal to 70 per cent of the British beef imports in that year. The sources were Argentina, Uruguay, Brazil, Australia, New Zealand and South Africa. Italy was the largest continental purchaser, taking 125,000 tons. Germany took 100,000 tons,

France and Belgium, each took 95,000 tons. Holland took 27,000 tons, Austria 10,000 tons, Hungary 1,000 tons and Czecho-Slovakia 6,000 tons. This continental trade in 1924 was double that of 1923 and four times that of 1922.[13] The year 1925 witnessed a small decline in its importance.[14]

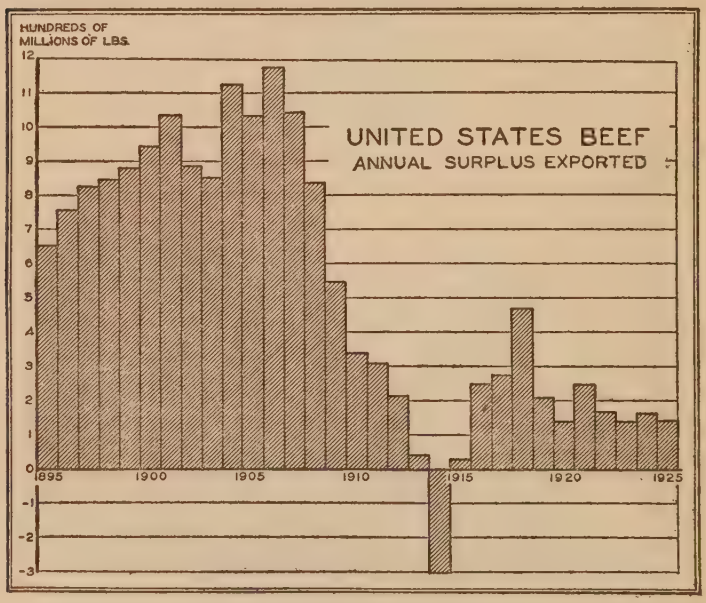

CHART 35.

The United States held the leading position in the exports of beef until the year 1905 when the product from Argentina took the first place and has held it ever since with the exception of the year 1918. The foregoing chart shows the net exports from the United States of beef, beef fats and cattle reduced to the equivalent of dressed

[13] Weddell and Company's *Annual Review of the Frozen Meat Trade*, 1924, pp. 4, 10.
[14] *Ibid.*, 1925, p. 11.

weight, from 1895 to 1924 inclusive. Data showing the exports alone or even the exports of beef alone fail to show the true relation of this country to the world's trade. Within some of the recent years the importation of Canadian cattle has been so heavy, amounting to more than half a million head in one year, that the actual beef exported has not always been strictly speaking entirely a domestic product. The imports of actual beef were also important in 1914 and 1915. There is no question but that the live and dressed products must be reduced to a common denominator to present a fair statement. There is a question, however, as to the inclusion of by-products. The exports during recent years have largely been confined to fats to the exclusion of flesh. In these products there has been, and probably will continue to be an important trade. Most of this is for food, much of the fat being made into oleomargarine in the other countries. This is a true contribution from the American cattle industry to the world's food supply and should be included in presenting the American foreign trade. Oleomargarine itself includes much vegetable oil and cannot safely be included. A real statistical problem arises in including the imports of live cattle. Obviously the fat cattle exported to England before 1912 represented more beef per head than the thin steers imported at various periods from Canada or especially the feeders formerly brought in from Mexico. A flat weight of so many pounds per animal for imports and exports would give erroneous totals. In the data from which this chart has been constructed account has been taken of this matter and the weight assigned to the live stock has been judged largely from their reported value in the customs returns. The results should not give errors large enough to appear in the chart.

It is interesting to note the almost steady climb until 1906, after which the surplus fell off rapidly and con-

tinuously for a decade. Even the stimulus of war demands failed to revive a semblance of the trade of the earlier period. The recent tendency is toward stabilization on the basis of the export of the by-products in small demand at home, and the amount of such trade is determined largely by the domestic consumption of the main products. In the present condition of the industry in other countries it

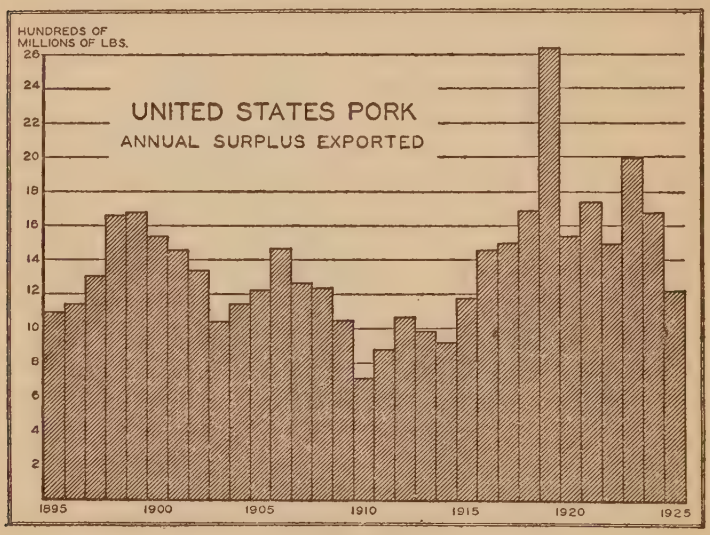

CHART 36.

seems unlikely that beef exports from the United States can be expected to be increased in the near future in the face of the cheaper supplies with which they would be compelled to compete.

The foreign trade of the United States in pork products is extremely important. The average annual exports from this country were 1,716,157,000 pounds out of a total of 2,483,896,000 pounds for the 24 leading nations in the years 1921 to 1923. There is practically no trade in live

hogs. The preceding chart takes account of such trade as exists in live hogs, and imports are deducted from the exports to give the true net position of the whole trade. Lard and lard oil are included in the totals as well as fresh and salt pork, bacon and ham.

The net exports of pork products was tending downward with periodic partial recoveries until war demands turned the scale and induced record-breaking shipments. The export of 1919 is a record that will probably not be equaled by any single country for many years to come. The post war tendency is toward continuation on a level equal to pre-war record shipments. This has been due in part to good weather conditions for the corn crop and in part to a large foreign outlet for the fat product of the American industry. How permanent these conditions are is a question that only the future will answer. Up to the present the other nations naturally adapted to the production of fat pork for the international market have not shown very strong tendencies to hasten such developments.

Great Britain is easily the largest purchaser of American pork products, and in spite of the fact that the type of bacon sold by the United States does not command the best price in the British market, enormous quantities of it are sold there.[15] Great Britain also usually takes over two-hundred million pounds of American lard a year. There is a large demand on the Continent also for American lard and for fat-backs and bellies. Germany is the chief customer, but France, Italy, Belgium and the Netherlands are also large buyers. Cuba affords a very important market for lard, bacon and other pork products from the United States. Mexico and the other Caribbean countries are also fairly large purchasers.

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[15] *Commerce Reports,* U. S. Department of Commerce, Oct. 9, 1922, p. 85.

The meat export trade of the countries of the Southern Hemisphere is portrayed sufficiently well in the charts of British imports. It is probable that these British data are much more accurate than the figures published by the South American countries for their own exports. The

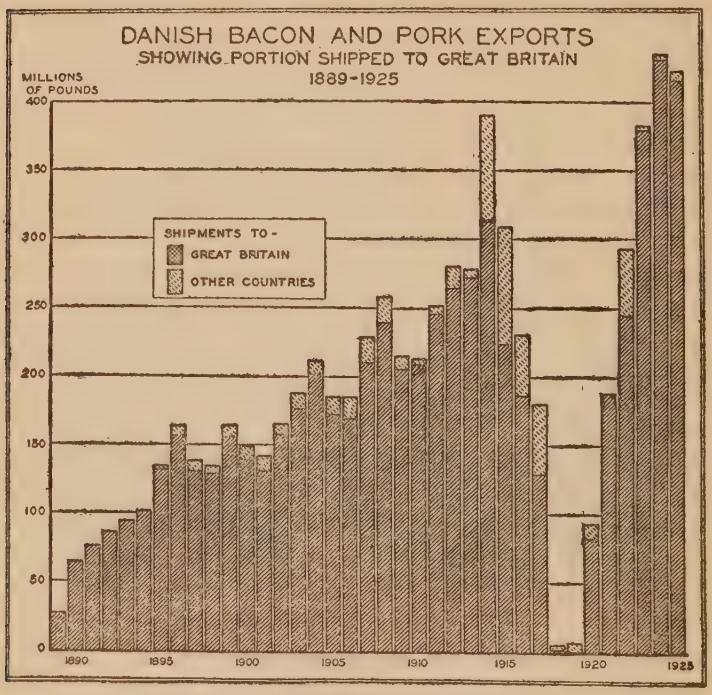

CHART 37.

pork exports of these southern countries are not noteworthy. The Danish exports of pork, however, are extremely important and the development of the trade in bacon, which holds the predominant position, is presented in the following chart. This trade, being based largely on imported feed, disappeared almost entirely during the

war, but has recently resumed its former upward trend. The British markets absorb practically all the lean bacon from Denmark.

There is a considerable trade in meats between the various countries on the continent of Europe. No single item bulks very large and many of the sources of surplus supplies have dried up since pre-war days. Abnormal commercial restrictions have also tended to reduce this trade. On the other hand, the splitting up of nations which resulted at the Peace Conference has created a condition such that trade which once was domestic will in future be international, for a trade in foodstuffs approximating that of former years must almost certainly be restored again with certain modifications between many of these regions.

The main problem in the international trade in meats has been the extension of markets for the surplus of the producing regions. The beginnings of the modern trade in Great Britain came after a period of rising prices, but the influx of new supplies was so heavy that it proved a real discouragement to the home producers. The general tendency of prices was downwards almost until 1896, and the lowest average price for imported beef appears to have been just before the outbreak of the war. On the Continent no demand developed for refrigerated meat until its enforced use during the war broke down the established prejudice. During all this time the producers' problem of securing a market seems to have outweighed the consumers' problem of securing supplies. While the initiative in international, as all other, trade lies in the pecuniary profit to the trader, the leading new movements in this trade were inaugurated by the leaders of the producers rather than the representatives of the consumers. In the years immediately after the war the production of the world's meat could be moved only at prices which were

ruinous to the producers. Fortunately the demand has now so far strengthened that the output is being purchased at prices that will permit of the healthy continuation of trade.

PART IV

CONCLUSION

CHAPTER XVII

THE FUTURE OF THE MEAT INDUSTRIES

THE developments of the future can be estimated only by considering what has happened in the past and is happening in the present. Not only the crass happenings, but the interrelation between all the most important factors, must be examined before attempting an intelligent forecast of the future.

CONSUMPTION HAS BEEN INCREASING

The general trend of meat consumption in the more settled countries has undoubtedly been upward during the past century. The leading countries of western Europe, for which data are available, have shown a tendency to consume more meat per person as the years have passed into decades. It is interesting to note that this increased consumption has accompanied a greater rise in the price of meat than grain.[1] Roughly speaking, this increased meat consumption has accompanied an increased earning capacity among the masses of the population. The trend of real wages was upward in the leading occidental nations

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[1] This is shown for Denmark in C. L. Christensen, *Agricultural Cooperation in Denmark*, U. S. Department of Agriculture, Department Bulletin No. 1266, p. 6; for France in *Foreign Crops and Markets*, U. S. Department of Agriculture, June 15, 1925, pp. 701, 703; and for Germany by Joh. Conrad, "Die Fleischteuerungsfrage," *Jahrbücher für Nationalökonomie und Statistik*, 3te Folge, Vol. 47 (1914), s. 145-175, and Joh. Hansen, "Untersuchungen über den Preis des Getreides," *Staatswissenshaftliche Studien* (Jena, 1887).

until about the end of the last century.[2] The temporary reversal of the upward trend of real wages [3] did not stop the tendency toward increased use of meat unless possibly that was the belated cause for an apparently general, but slight, tendency toward decline immediately before the war. The upward trend in meat consumption continued until about the end of the first decade of this century. The temporary downward movement of real wages in the early part of this century was an accompaniment of the recovery of the balance between agriculture and industry which had been lost in the very real overexpansion of the former culminating in the latter part of the last century.[4] During these years of the recovery of this balance, food prices were recovering from their low position, as related to other prices and wages, and inevitably the purchasing power of wages declined. Now that this balance has reached a position which is more normal, the trend of real wages appears to be returning to its earlier upward direction.[5] Meat consumption is also increasing in many places where the degree of recovery from the war-born economic disturbances permits. In Central Europe the recovery as a rule has not yet reached the stage where meat consumption is greater than before the war. In the western countries there is a tendency for the demand to increase generally in spite of a lack of real prosperity and in the leading nations the consumption has recently been at new high levels for all modern times.

In the newer nations of South America and Australasia,

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[2] J. Kitchen, "Trade Cycles Chart," *The Times* (London), Jan. 28, 1921; E. Mahaim, "Changes in Wages and Real Wages in Belgium," *Journal of the Royal Statistical Society*, 1904, pp. 430-438.

[3] "Real wages" here means the amount of the necessaries of life purchasable by the money wage.

[4] McFall, "The Balance between Agriculture and Industry," *The Annalist*, Nov. 7, 1921.

[5] P. H. Douglas, *Proceedings of the Academy of Political Science*, January, 1925, pp. 90-98.

animal husbandry being the pioneer industry, the meat consumption was so high in the early days that the advance of years brought a wider variety of food and a lessened use of meat. The decrease in actual consumption was probably not so great as the available statistics would indicate, for the waste in the early days was unquestionably very large. It is almost certain, however, that the amount of meat actually eaten per person decreased temporarily as the frontier stage of civilization was left behind. The extremely heavy consumption in frontier conditions may be regarded as abnormal.

In the United States the trends are less certain. During the decade before the war the price of beef rose so violently in the United States, when the national surplus disappeared, that almost all vestiges of the "frontier" conditions were banished and the consumption of meat in general declined. However, the best available evidence indicates an increase in the use of meat throughout the past half century or so, as a single period; and the official statistics show clearly that the tendency is upward again since real wages have resumed their advance.

In the nations of the earth where occidental civilization has least influence, meat eating as a rule is more limited. Here again very striking exceptions must be made for the Arctic tribes, whose diet is almost exclusively carnivorous, and the nomadic tribes of Asia who live largely off their flocks and herds. With these exceptions meat tends to disappear from the diet the farther we go from the influence of western civilization whether in densely populated southern Asia or sparsely populated Africa. On the other hand, as this influence grows in these countries meat consumption becomes more popular. This is true of those Japanese who can afford to eat meat as well as of the really uncivilized blacks of Africa who adopt the white man's diet when they are induced to work in the

white man's mines. Meat consumption also tends to be greater in densely populated western Europe than in the less crowded and less advanced regions of eastern Europe. Dense populations as well as sparse are thus affected by the influence of the habits of occidental civilization.

There are two factors behind the major national variations in meat eating. One is the relative abundance of meat on the frontier and semi-arid grazing lands of the nomads. The other is the relative development of the material standards of living associated with occidental civilization. Whether or not meat eating is one of the causes of racial attainment is an open question. It is quite evident, however, that it is an effect of the higher purchasing capacity which comes with the development of material civilization. How jealously civilized man might maintain this dietary standard if confronted with a higher real cost of food is another question.

THE RELATIVE GROWTH OF MEAT PRODUCTION AND AGRICULTURE

The production of meat necessarily keeps pace with the consumption throughout a period of years. Too many superficial conclusions regarding meat production have been drawn from the trend of the mere numbers of live stock appearing in the estimates of the flocks and herds of the world and its chief nations throughout a period of years. Such a criterion is inadequate as an index of the changes in meat production throughout a long series of years. The actual production of meat in the world has increased much more rapidly than have the numbers of animals in the annual estimates. The production increased more rapidly than human population before the war, for otherwise increased per capita consumption would have been impossible. This increase in meat production, in the

half century before the war, came partially from increases in the flocks and herds and partially from the increased productivity per unit of these flocks and herds, due to a more rapid turnover with younger slaughtering and to improved breeds and breeding practices. Immediately before the war the numbers of sheep were declining rapidly, and while the pigs were increasing materially, the numbers of cattle were not much more than holding their own on the average in the chief countries.[6] It is a question also if improvements in animal husbandry were being adopted sufficiently rapidly a decade and a half ago to bring about an increase in the world's meat production that quite equaled in rate the increase in human population.

The war, of course, did much to set back the meat-producing industries in many countries. The western European countries on the whole saw their live-stock population decreased in numbers and lowered in meat-producing capacity per animal. On the other hand, the disturbed conditions stimulated outside production, particularly in North America which was most readily accessible to the European market. The war also extended the use of meat to elements of the European population that had consumed but little before. They learned to like meat and gave up much of their prejudice against imported frozen meat. Thus the demand was stimulated. The agrarian revolution which has swept over eastern Europe as an aftermath of the war appears, on the other hand, to have laid the foundations for increased meat production, for animal husbandry almost always plays a larger part in the farming of the small peasant holdings than in the extensive farming of the old landowners.

When the smoke of war had begun to clear away, the

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[6] Holmes, *Meat Situation in the United States,* Part I, Report No. 109, U. S. Department of Agriculture, p. 67.

supply of meat had increased more than the effective demand. The appetite for meat had increased, but the means of payment had decreased. As a result, prices went to ruinously low levels. Events of the last year or so show that to have been a passing phase of the underlying developments.

The tables on pages 576-583 show the changes in the live-stock population in the leading meat-producing nations. More complete estimates made by the International Institute of Agriculture show the world situation as a whole more clearly. The following table shows the percentage relation of the estimated animal populations in each country in 1921 as compared with 1911:

PERCENTAGE RELATION OF THE NUMBER OF ANIMALS IN 1921[7] TO THE NUMBERS IN 1911

	Cattle	Sheep	Swine
Europe	95.8	91.8	85.1
North and Central America	114.2	74.3	87.1
South America	94.4	67.6	97.5
Asia	111.6	97.3	66.3
Africa	127.6	102.3	100.3
Oceania	114.3	84.5	72.9
World	105.5	84.4	80.0

These estimates are based as far as possible on the official data of the various national governments. Such basic data, of course, are incomplete and do not in all cases cover the years 1921 and 1911. The data for the nearest possible years have been used when those for the exact years were unavailable and the resulting estimates for the world and its major subdivisions are reasonably accurate and show the immediate results of the war. It is evident that the results of the war were unfortunate for the live-stock industry.

[7] *International Yearbook of Agricultural Statistics*, 1909-1921, pp. lxxix *ff*.

More recent estimates of the Institute show a more hopeful picture. The following table compares data for 1924, or the nearest available year, with comparable data for 1913:

PERCENTAGE RELATION OF THE NUMBERS OF ANIMALS IN 1924[8] TO THE NUMBERS IN 1913

	Cattle	Sheep	Swine
Europe	105.7	112.0	100.5
North and Central America	113.1	70.9	104.4
South America	118.0	78.5	85.4
Asia	98.9	91.7	142.2
Africa	135.8	100.0	82.2
Oceania	124.8	95.1	114.5
World	109.1	94.9	102.8

It is apparent that the tendency toward a decrease in the number of sheep, which was noticeable for a long time before the war, is still persisting. There is no reason to suppose that there are now a sufficient advance in the use of better mutton breeds and more rapid maturing of the animals to offset the loss in their numbers. The production of mutton and lamb apparently is not being maintained. The sheep, as it is ordinarily raised, is a frontier animal and is tending to become less important as the frontier in the temperate regions succumbs to more settled agricultural conditions. Moreover, the profit in sheep raising depends largely upon the price of wool and the long-time trend in the price of wool is downward.[9]

It is interesting to note that the numbers of cattle in the world have increased more rapidly than the swine since pre-war days, whereas, before the war, as already noted, it was estimated that cattle were barely holding

[8] *International Yearbook of Agricultural Statistics*, 1924-1925, pp. lxxvii *ff*.

[9] *Agriculture Yearbook*, U. S. Department of Agriculture, 1923, p. 299.

their established position while swine were increasing considerably.

It is impossible to determine, statistically, what changes have taken place in the average productivity of the herds in this last decade. There is no question but that for a time the productivity of the animals was greatly reduced in Europe. This situation has now practically passed and there is considerable reason to suppose that the general disturbances of war and its aftermath brought about improvements in all branches of farming, including animal husbandry, that were already overdue and that the net result in this field is an increased unit productive power of the herds.

It would be of great value in forecasting the probable future of the meat industries if we had available a series of carefully worked out studies for various parts of the world showing the relative profitableness of farming with and without animals. Many difficulties stand in the way of satisfactory results in this field either from experiments or surveys. It would be necessary to make certain that equally careful attention and skill were devoted to production and marketing of both the crops and the animal products, that facilities for each were equal and that the highest known productive strains of each were used. Even with these conditions right it would be necessary to continue the observations over a long series of years, the relative level of prices in the two lines of farm products being far from constant. It would also be necessary to estimate very carefully what was the true economic relation between the two activities carried out on the same farm. The results of surveys of profits on farms where live stock is maintained, in a limited number of the examples, give no answer to the question. It is self-evident that any side line is likely to be less profitable than the main enterprise on any farm.

The question of the profitableness of meat producing can hardly be solved by simple surveys and limited observations. It is small wonder that there is a dearth of such studies. The problem is so complex that the only answer to it may be looked for in the results which agriculturalists in general give to it in the light of their practical experience in farming year in and year out. Unfortunately, farmers are poor cost accountants. The issue is not so beclouded, however, but that a general farming population has sufficient data available on which to base fairly good economic judgments. The production programs based upon such experience can never be counted upon for a sensitive response to comparative profits, but in the course of years and over wide territories the answer which farming programs give shows what practices are more profitable. The rural communities which fail to follow this rule can be readily detected by their backwardness.

The immediate answer to the question from this source is that animal industry in the world is increasing its output and is therefore profitable.

There is evidence that the world's animal population hardly held its own, let alone followed the increase of human population, during the first part of this century. The superficial assumption from this that the animal industry is declining and being supplanted by other forms of food production is not justified, however. The British per capita consumption of meats rose in the first decade of the century, since when it varied up and down with a small increase. If British consumption of meat, which depends upon the world supply, was maintained in the face of a declining world production, there was only one way it could have been accomplished; *viz.*, by comparatively increasing prices. By the year 1913 the true weighted average price of all imported supplies of the chief animal products entering Great Britain had increased 22 per cent since the beginning

of the century, while commodity prices in general had increased only 14 per cent. An index number based upon any single line of meats might show a variation from this figure given. The best standard, however, for this question is this weighted average of all classes, the cheap types mixed with the dear in such proportions as they came. There is no question but that this price index, which indicates the pressure of demand upon supply, shows a failure of supply to keep pace with the demand of increasing population during that period. A rise in price just equal to the general rise in prices or falling value of money would have indicated a constant relation between supply and demand. A greater rise of price of meats shows a relative failure of that supply. The most striking fact right here, however, is that the weighted average price of wheat had increased by exactly the same percentage as had the price of animal products by the year before the war. Numerous oscillations occurred in all prices during the early years of the century, but the year 1913, which showed no violent fluctuation from the normal increase of price of either class of food, found their index numbers at the same point.[10] Evidently, it was agriculture as a whole, not animal industry in particular, that was failing temporarily to keep pace with demand. As we have already noted, the expansion of industry between the nineties and the outbreak of war decidedly outdistanced the expansion of agriculture. The status of the latter in the last decade of the nineteenth century after its phenomenal expansion of many decades indicates that we had in 1913 a much healthier and more normal balance in our economic production than what existed two decades earlier. In other words the changes in the two decades before the war were merely a recovery from

[10] McFall, "Canada's Opportunity for Exports of Food," *Monthly Bulletin of Agricultural Statistics,* Dominion Bureau of Statistics, May, 1918, p. 6.

an abnormal situation caused by a temporary overexpansion of agriculture.

The outstanding result of this examination of statistics is the evidence that the production of meats kept pace with the development of agriculture even during the period immediately before the war. In the latter half of the last century there can be no question of the increase in the output of animal husbandry, particularly in the leading nations of western Europe. Even Germany had developed her animal husbandry more rapidly than her crop production.[11] Instead of giving up meat production as agriculture became more intensive, animal husbandry in many countries has become more important and the popular use of meat has grown. Part of this production, of course, is based upon imported feed, but the greatest part depends on the product of the increasingly fruitful home soil.

All the available evidence leads to the conclusion that postwar developments have resumed the long-time trends of the expansion of meat production in company with that of other food supplies. The pre-war slowing up in development was an adjustment following the over-rapid expansion culminating at the end of the last century. The rough balance having been restored between the world's population growth and the expansion of its food supplies, movements are now again following the general trend of the past century, which gave a moderately increasing per capita supply of meats and others of the choicest foods as well as of the bare essentials for maintaining life.

THE FUTURE OUTLOOK

What will the future bring forth? It is not desirable that the per capita supply of meats should be indefinitely

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[11] Middleton, *The Recent Development of German Agriculture,* pp. 57, 60.

expanded. Many population groups already use all the meat which is desirable physiologically. Many people, however, even in the nations with as high average consumption records as the United States and England fail now to obtain as much meat as would be good for them. In many of the nations in the temperate zone the consumption could be generally increased with real advantage. The desirability of a large consumption in the tropics is questionable. The probability of a great increase in the Orient is quite remote. Nevertheless, there is still much room for the increase of meat consumption in the world even aside from an expansion in the population.

What will happen as the human population expands? That again depends upon whether the rate of human expansion exceeds the increase in the rate of food production. If man increases until hunger stares him in the face he may have to give up his present degree of dependence upon animal food. In the light of the evidence presented in the foregoing pages this would be a great social misfortune.

But what reason is there to suppose that men will increase more rapidly than their food supplies? An adequate discussion of this question that has been troubling people for so long would require another volume. The evidence presented in the preceding pages shows that the limits of the production of meat are far from having been reached; that many efficiencies in production can still be introduced and that the expansion of population which has come with modern civilization and industrialism has increased the meat production in old as well as in new lands and permitted an expansion of the per capita consumption. Up to the present the food supplies have grown faster than the population and civilized man has supplied himself with a larger proportion of animal foods which do make larger demands upon farm production than the vegetable

products. The past and present trends give no cause for pessimism.

It is claimed by some writers, however, that human population tends to expand indefinitely and increasingly [12] and it must be conceded that there is a limit to the world's food-producing possibilities.

Some writers paint a distressingly dark picture. There are two weaknesses in this general argument. The food resources of the earth are greater than some of the ablest men have surmised [13] and statistical and other evidence fails to support the conclusion that population tends to expand indefinitely and increasingly. The population in France shows practically no tendency to expand. Professor Raymond Pearl has shown much statistical evidence to support the conclusion that the growth of any community tends to follow the rule of the growth of any individual person or animal, first rapidly increasing growth, then a slackening of the increase until stability is approached and reached at maturity.

There are many other limitations on the growth of nations and the world's population than the food supply. There is room for an argument to the effect that the Orientals increase their numbers up to the limits of their food resources. Western civilizations have shown a much closer relation between their growth and other factors than the food supply. The material bases for industrialism have

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[12] J. M. Keynes, "An Economist's View of Population," *Manchester Guardian Commercial, Reconstruction in Europe,* Aug. 17, 1922, p. 340; E. M. East, *Mankind at the Crossroads,* pp. 8, 12, 349.

[13] Compare the gloomy forecasts of Sir William Crookes in his presidential address before the British Association in 1898 with recent happenings. Sir William prophesied that within a generation the United States would be dependent upon imported wheat and that by 1931 the world population growth would have overtaken the potential increase in the wheat supply. Since the War, with Russian potential supplies practically off the world's markets through political causes, the American wheat growers have been faced with real hardship for lack of a sufficient market.

done more to stimulate the growth of peoples in the west than the supply of food, and other factors are likely to prove more powerful than the food problem in bringing about a slackening of the growth of population.

Professor Pearl's evidence suggests that there is some social force comparable to a biological law which determines the expansion of human numbers. Whether or not that is true, it is becoming evident that the mineral resources for power and structural purposes, which are not perennial as the food supply is, should give more cause for alarm than food. The costs of food distribution are more alarming to-day than are the costs of food production on the farm. These marketing costs have multiplied in this last century and there is cause to conclude that they are found at their worst in the centers of dense industrial populations.[14] The zeal to maintain high material standards of living also works powerfully against any undue rate of human expansion in the communities which are more highly civilized according to western standards.

The maintenance of a satisfactory diet including a due proportion of meat is one of the material standards of living that is very important in the western world. To relinquish this standard would probably have serious consequences. Fortunately there seems to be a stronger tendency to maintain such material standards than even to increase the population in the more highly civilized western nations. As already noted, the increased meat consumption on the continent of Europe in the last century was accomplished in spite of the fact that meat was growing more costly than cereal foods. Of course, it is impossible to be certain that nothing will undermine the virility of the western peoples and cause them to relinquish their standards. Civilizations, like individuals, may grow old and

[14] McFall, "The Higher Cost of Food in Massachusetts," *Journal of the Statistical Association*, September, 1924, pp. 362-377.

die. Of this, however, there is no proof and all the present indications point to the conclusion that other factors than the food supply will hold human expansion within reasonable bounds and that civilization will jealously maintain and enlarge its material standards of living.[15]

If such proves to be the result, what will happen to the meat industries? They may be expected to expand and consolidate themselves on the basis of increased efficiency.

While the marketing of meat seems to-day to be considerably more efficient than that of most other food products, a great deal remains yet to be done. The process should be still further cheapened, particularly in the retailing. Some means must also be worked out for utilizing a larger share of the beef fats which are now so commonly wasted in the hands of the consumers. The largest task before the marketing system is to fit production more closely to the demand, and do away with the unfortunate losses which frequently come to the producers from the fluctuations in the relation of the supply to the demand.

Production can and will be modified considerably as expanding demands make theoretical economies practical. The sheep may not continue to maintain its relative position. The answer to this problem depends largely upon the demand for wool. However, mutton and lamb production is so thoroughly established in the settled agriculture of western Europe that the sheep industry cannot be expected to be confined solely to the narrowing frontier of agriculture. The production of fat pork may readily be expanded very greatly in many parts of South America,

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[15] McFall, "Factors Limiting the Expansion of the Human Race," paper presented at the Institute of Politics, *The Annals*, March, 1924, p. 257.

Idem, "Mutual Reactions between Population Growths and Factors Most Closely Related Thereto," paper presented at the Institute of Politics, 1925.

Idem, "Is Food the Limiting Factor in Population Growth?" *The Yale Review*, January, 1926.

Africa and southeastern Europe. Bacon pigs will continue to expand with dairying. Beef production will tend to become more closely associated with general crop production and probably with dairying. Lands fit only for pasturage can be made more productive and used for the maintenance of part of the breeding herds, but cultivated land is generally so much more productive of meat in addition to other human food that the more extensive and less fundamentally efficient types of animal husbandry will yield ground to the more intensive types which use the soil efficiently and finish the animals promptly with the least possible waste. More intensive animal husbandry may require more human labor per unit of output. The relative growth of the animal industries in Europe and the newer lands leads to the conclusion that this stage of development has hardly been entered as yet. In time, however, it may come and it will be no social misfortune, for animal husbandry is an excellent calling.

INDEX

Abyssinia, 397
Adults, greater value of meat than of milk in diet of, 18-19
Afghanistan, 362
Africa (Chapter IX), 366
  British West, 392
  disease, 366, 371, 372, 381, 389, 393, 395, 396, 399, 404
  French Equatorial, 403
  French West, 404
  Portuguese East, 401
  Portuguese West (Angola), 400
  Union of South, 367, 576-583
Agriculture, relative development of meat production and, 164, 189, 218, 227, 235, 246, 249, 266, 296, 304, 306, 308, 314, 327, 330, 357, 450, 606
Alaska, 152
Algeria, 408
Amino-acids, proteins built up from, 8
Angola (Portuguese West Africa), 400
Animal husbandry, economy of, when based on feed not usable by man, 66
  influence of social factors on, 76
  mixed farming and, 92
Animal husbandry, place of in various stages of economic development, 74
  relation of, to density of population, 68
  soil fertility and, 57
Animals, relative efficiency of younger, 54
Argentina, 441
Armour, P. D., 554
Asia, conditions in (Chapter VIII), 325
  Western, 326
Asiatic Russia, 326
Australia, 413, 573, 576-583
Austria, 276, 577-583

Baby beef industry, 95, 133, 198
Baltic States, 310
Basutoland, 377
Bechuanaland Protectorate, 379
Beef, triple function of, in Europe, 93
Belgium, 226, 577-583
Big business, place of, in meat marketing, 568
Bohemia, 283
Bolivia, 483
Brazil, 467, 572
Breeds, 171, 248, 288, 344, 350, 356, 443, 460, 468
  degree of distribution of modern, 84

Breeds, development of modern, 81
influence of improved, 80
British combinations, 565
Bulgaria, 297

Cameroons, 394
Canada, 501, 576-583
Carbohydrates, action of, in digestion, 23
relation of use of, in diet to saving of protein, 10
simplest forms of energy bearing foodstuffs, 5
Caribbean countries (Chapter XII), 489
Cereals, insufficiency of, as source of protein, 17
Ceylon, 361
Chile, 485
China, 330, 573
Climate, influence of, on meat production, 76
Colombia, 478
Combinations, British, 565
in the meat trades (Chapter XV), 551
Congo, Belgian, 398
Consent Decree, 560
Consumption, Argentina, 457, 576-582
Austria, 276, 577-583
Belgium, 231, 577-583
Canada, 512, 576-582
Denmark, 253, 577-583
fitting production to, 528
France, 190, 576-583
Germany, 255, 577-583
Great Britain and Ireland, 154, 576-583
increase of, 4, 603
Consumption, Italy, 212, 577-583
Madagascar, 411
Netherlands, 237, 577-583
New Zealand, 436, 576-582
optimum, 37-40
regional variation of, in the United States, 117
Rhodesia, 383
Russia, 317
Spain, 207, 577-583
Union of South Africa, 373, 576-583
United States, 111, 576-582
Uruguay, 463
Venezuela, 477
Coöperation in Denmark, 244
Coöperative buttermaking in Siberia, 327
Coöperative enterprises, 566
Costa Rica, 490
Costs and profits of marketing, 543
Cuba, 497, 573, 574
Cured meat, early trade in, 587
Cyprus, 365
Cyrenaica, 402
Czecho-Slovakia, 283, 573

Dairying, 48, 52, 73, 93, 132, 172, 179, 198, 200, 208, 221, 225, 231, 237, 246, 268, 280, 301, 304, 307, 310, 314, 327, 331, 346, 358, 360, 373, 422, 425, 434, 449, 458, 508, 618
Denmark, 242, 572, 576-583
Digestion, action of proteins in, 9
Disease, 79, 85, 325, 340, 366, 371, 372, 381, 387, 389, 393, 395, 399, 404, 417, 447, 473, 477, 493

Distribution and development of meat production (Chapter III), 68

Economic development, influence of, on meat production, 88
Economy of meat production, 64, 66
Ecuador, 480
Egypt, 396
Eggs, unique place of, in human diet, 18
England. *See* Great Britain and Ireland
Eritrea, 401
Eskimos, exclusive meat diet of, 25
Esthonia, 310
Europe, the continent of (Chapter VII), 188

Falkland Islands, 487
Fats, 6, 21
  desirability of, in diet, 22, 24
  importance of, in meat, 21
  presence of, in lean meat, 22
  slow digestion of, 23-24
  use of, in cellular structure, 22
Federal Trade Commission, report on packers, 558
Feed, 64-67, 76, 182, 202, 221, 223, 230, 238, 250, 303, 324, 340, 368, 418, 430, 446, 469
  pasture *vs.* cultivated crops for, 56
Feeder industry, 96, 99, 132, 176, 504, 507
Fertility, animal husbandry and soil, 57, 201, 226, 321
Fiji Islands, 438
Finland, 306
Food, competition between man and beast for vegetable, 44
  different classes of, 4
  importance of meat as, 3
  physiological function of, 4
Food producers, relative economy of different animals as, 47
Food production, chemical processes of, 42
  relation of meat to (Chapter II), 41
Foodstuffs, chemical classification of, 4
Foreign trade, Uruguay, 462
France, 190, 576-583
Frontier methods of meat production, 90

Germany, 255, 576-583
Glandular organs, high protein content of, 19
Government control boards, 567
Grass-fattening in Great Britain, 100
Great Britain and Ireland (Chapter VI), 154
Greece, 299
Guatemala, 493
Guiana, British, 474
  Dutch, 474
  French, 474
Guinea, 393

Haiti, 498
Honduras, 491
  British, 494
Hungary, 278

Imported feed, dependence of leading nations on, 70, 75, 182, 202, 221, 223, 230, 236, 238, 250, 269
India, 356
Indies, Dutch East, 355
Indo-China, French, 351
  French, international trade, 573
Inspection, 531, 590
International trade (Chapter XVI), 571
  Argentina, 453
  Belgium, 233
  Brazil, 473
  Canada, 512
  China, 337
  Denmark, 253
  development of, in leading countries, 591
  Germany, 270
  Italy, 221
  Madagascar, 411
  meat in France, 204
  Netherlands, 237
  prewar Austria, 272
  prewar Russia, 319
  Spain, 209
  United States, 148
  Uruguay, 462
Ireland, 174
Italy, 211

Japan, 346

Kenya Colony and Protectorate (British East Africa), 389
Korea, 345

Lamb, "hot house," 105
Lamziekte, 371
Lancaster Co., Penna., feeding industry in, 99
Latvia, 310
Liberia, 403
Lithuania, 310
Live stock, early trade in, 575

Macdonald, James, 162
Madagascar, 409, 573
Malaya, British, 354
Manchuria, 341
Marketing, problems and agencies (Chapter XIV), 523
Markets influence meat production, 76
Meat, domestic supplies of, in Great Britain, 159
  economy of turning vegetable products into, 64
  how much should be eaten, 36
  importance of flavor of, in preparation of other foods, 36
  mineral requirements in, 25
  nutritional experiments in use of, 12
  objections to the use of, 31
  relation of, to food production, 41
  superior type of protein, 11
  use of, most notable among western Europeans, 3
Meat industry, future of (Chapter XVII), 603
Meat marketing, place of big business in, 568
Mesopotamia, 362
Mexico, 494
Milk, insufficiency of sole diet of, 25

Milk, value of protein content as compared to that of meat, 18
Mineral requirements in meats, 25-27
Mixed farming, animal husbandry and, 92
Mongolia, 342
Montenegro, 292
Morocco, 406

Netherlands, 234, 573, 577-583
New Caledonia, 439
New Guinea, British, 428
New Zealand, 428, 572, 576-582
Newfoundland, 518
Nicaragua, 491
Nigeria, 394
North America, marketing in, 537
Northern Rhodesia, 386
Norway, 301, 573, 577-583

Oceania (Chapter X), 413

Packers, 551, 552
  American, in foreign countries, 562
  government investigation of, 558
  in Canada, 561
Palestine, 363
Panama, 489
Paraguay, 463
Pedigreed stock industry in Great Britain, 171
Peru, 480
Philippines, 349, 573, 575
Pig production, types of, 106
Poland, 307
Porto Rico, 153
Portugal, 210
Portuguese East Africa, 401
Portuguese West Africa, 400
Profits and costs of marketing, 543
Proteins, action of, in digestion, 9
  biological value of, in various foods, 12-19
  complexity of, 7
  difference in value of different, 8
  less of animal origin required than of plant origin, 10
  question of minimum in diet, 10
  required for building of bodily tissue, 4
  superiority of animal to that of vegetable, 10, 15-16, 19
  use of, for tissue-building, its chief function, 20

Refrigerated meat, introduction of, in United States, 555
  trade in, 205, 319, 588
Reindeer, in Alaska, 152
  industry, in Sweden, 305
  propagation of, in Arctic North America, 86
Rhodesia, frontier ranching in, 91
  Northern, 386
  Southern, 380
Rome, soil fertility in ancient, 58
Roumania, 294
Russia, 311, 576-583

Salvador, 492
Samoa, 438
Serbia, 292
Sheep production, types of, 102
Siam, 353
Siberia, 326
  coöperative buttermaking in, 327
Sierra Leone, 392
Sin-Kiang, 345
Social factors influence meat production, 76
Soil, influence of, on meat production, 76
Soil fertility, animal husbandry and, 57
  in ancient Rome, 58
  in medieval Europe, 58
  relative condition in Elizabethan and Victorian periods, 58
Somaliland, British, 392
  Italian, 402
South Africa, 367
South America (Chapter XI), 440
  international trade, 573
South Pacific Islands, 438
Southern hemisphere, marketing in, 536
Southern Rhodesia, 380
Spain, international trade, 209, 573, 577-583
Starch, action of, in digestion, 22
Statistical summary for the leading countries, 576
Sudan, Anglo-Egyptian, 391
Swaziland, 377
Sweden, 302, 573, 577-583
Swift, G. F., 554
Swine, dispersion in Europe, 71
Switzerland, 224, 573, 577-583
Syria, 363

Tahiti, 439
Tanganyika Territory (German East Africa), 388
Tibet, 345
Togoland, German, 392
Tonga, 438
Topography, influence of, on meat production, 76
Tripolitania, 402
Tunis, 409
Turkey, 364
Types of meat production (Chapter IV), 87

Uganda Protectorate, 390
United States, 111, 576-583, 587, 594-597
Uruguay, 457
  international trade, 462, 572
  live stock industry, 459

Veal, production of, in Netherlands, 101
Vegetable products, economy of turning into meat, 64
Venezuela, 475
Vitamins, essential to health, 5
  meats and, 27

West Africa, British, 392
  French, 404
West Indies, British, 499
Western Europe, history of livestock industry, 188
Wheat, source of protein, 16

Younger animals, relative efficiency of, 54
Yugoslavia, 289

Zebu, use of, in cross-breeding, 85

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